THE

# ELECTRICAL REVIEW.

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## ELECTRICAL REVIEW.

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## ELECTRICAL ACCIDENTS IN MINES AND THEIR PREVENTION.

EVER since the introduction of electricity in mines the question of the prevention of accidents and the risk of danger involved in its use has been a source of great concern, not only to the owners and managers of mines, but also to the workmen employed in and about the mines, the Government Inspectors, and manufacturing firms specialising in electrical machinery for mines, and in no other industry has the application of electricity been so much discussed. Why?

On another page we conclude our excerpts from the annual reports of H.M. Inspectors of Mines for the year 1912, and with one or two exceptions which, although even these ought not to have happened, can be described as pure accidents, all were clearly preventable had the installations been installed and maintained not only as they ought to be for the proper working and intelligent use of the apparatus, but according to the instructions contained in the special rules relating to the use of electricity in mines.

Year after year there is a recurrence of these accidents; every time an explosion takes place the first conclusion jumped to is that it must be due to electricity—and the wiseacres shake their heads and say it ought not to be allowed. Steam, compressed air, and hydraulic power can all be controlled and directed without danger or risk of fire, but with electricity—Ah! That's different! No one knows what it is, or how it can be kept from breaking out!—This may sound far-fetched and even foolish, but it accurately describes the attitude of the non-technical public towards this question, and every mining disaster intensifies the feeling.

Now why should this be? For a moment, let us examine how mining differs from other industries; and, first, we must consider whether it is more hazardous. Undoubtedly, as regards falls of roof and side it is, as no matter how carefully the roof may be supported, some totally unexpected and unforeseen break in the strata may occur which will cause a fall, and the majority of accidents in mines are from this cause. For the year 1911, for instance, 56·3 per cent. of the accidents underground and 55·1 per cent. of the number of deaths, were due to falls of ground. But, with this exception, it cannot be said to be more dangerous than any other industry, and in many respects it has advantages in regard to length of working hours, wages and health conditions which more than compensate this risk. Even the number of these accidents could undoubtedly be reduced if proper care were taken; but as Mr. Redmayne says: "many of these accidents could not be foreseen. But I agree with Mr. Nicholson, 'in their anxiety to get coal, many hewers put off setting the necessary roof and coal supports until it is too late.' There is no doubt that many men have, unfortunately, lost their lives on this account."

The more important question, however, is that of the risk of an explosion; we dealt with this in our issue of November 7th, and, we think, clearly showed that the adoption of electric safety lamps, strict discipline regarding smoking and carrying matches, and the more careful use of explosives would very greatly minimise this danger, and what is more, as we have pointed out on previous occasions, the use of electric lamps by the better light obtained would tend to reduce the number of accidents from falls of ground. All other risks of accident in mining are practically the same as in

any other industry, and as it has been said that the safest place one can possibly be in is a railway carriage, so it may be said that the safest industry one can be employed in is that of mining. Electricity became necessary to the efficient working of mining operations in exactly the same way that it has become necessary to other industries, and it cannot now be dispeused with, any more than ordinary business people could do without the telephone.

Other industries, however, are probably more closely allied to mechanical engineering, and the actual operation of getting coal is not as yet a mechanical operation—though it is fast becoming one. Certainly mechanical engineering enters very largely indeed into the transportation and preparation of the mineral for marketing, but the actual working of the mineral itself is not mechanical, and, in fact, a "good pitman" is very frequently a "bad mechanical engineer." And here we have the crux of the whole question. A mining engineer must be trained in the science and art of mining, in which are embraced geology, the chemistry of gases, breaking ground, winning and working areas of mineral, ventilation, surveying, &c., and he only has time to study in a very elementary way the construction of the various mechanical appliances which are brought into use. He is not a mechanically-trained engineer; but as a mine manager he is by law responsible for all the mechanical and electrical machinery employed in or about the mine, and as a rule "he thinks he knows." But when electricity came to be installed, he did not know enough of this science to select proper machinery; he relied upon competing electrical firms, who knew nothing of mining, and the representative with the glibbest tongue and the lowest price got the order, and it was this sort of thing which led to the introduction of the electricity special rules as the only means of preventing bad workmanship and maintenance.

What is the remedy? It is quite simple, and merely needs the division of the responsibility between the "mining" engineer and the mining "mechanical and electrical" engineer. Train both properly in their respective departments, and make each responsible to the law, and it will pay. This is not the first time we have made this recommendation; we even went so far on one occasion as to suggest the formation of a Colliery Engineers' Association, and this led to the inception of the Association of Mining Electrical Engineers, which recently held its annual general meeting at Birmingham. Originally, we believe, the intention of its founders was to carry out the purpose suggested by us, and this is evidently borne out by the president, Mr. Anderson, when he says, "There was a danger at the start of drifting into Trade-Union tendencies"; but it was captured by the colliery managers, who soon put an end to any hopes the original founders of the Association had of improving their status. As one manager remarked: "We could not allow them (the electricians) to become independent. We must be top dogs." Now, Mr. Anderson deplores the lack of intelligent colliery engineers.

Continuing, Mr. Anderson goes on: "Unfortunately a number who joined at first with this object in view have now ceased membership." In June, 1913, out of 1,081 members only 120 were certificated members, but Mr. Anderson is very hopeful of the future, as "to be a member is a commercial asset of no mean value, and under this head I include (*a*) those who look for status, and (*b*) those out for trading purposes"—and we take it that 80 to 90 per cent. of the members are of the latter order. They will flatter the manager up to the skies to get an order, and blame the colliery electrician if anything goes wrong with it afterwards. And yet Mr. Anderson wonders why "it is very difficult to get really first-class men!"

Of the two occupations of coal hewer and colliery electrician, the former is probably the better off, as he gets about the same wages, works a less number of hours, has less responsibility, and is *absolutely independent*, as his Union will back him up in all that he does or asks for, but the electrician—poor fellow! Why is it difficult to get good men?

According to Mr. Anderson, "Many young men who enter the profession do not seem to realise the necessity for beginning their theoretical education at once, but rely solely on what years of practical experience may teach them. They do not seem to grasp the fact that a smaller number of years, combined with hard study, would make them competent and efficient professional men that all should aspire to become." We agree, but must point out that it takes the same study to become a colliery manager—and in the one case there is an open road to the highest position in the mining profession; in the other, there is no opening whatever to the great majority. A few may get decent positions which are limited to £200 or £300 a year, but even then there is *always* the colliery certificated manager *above them*.

Does the Association intend to improve the status of the colliery engineer or electrician? Not it. Ninety per cent. of the members are members for what they can get out of it in the shape of business, and all this talk of improving mining electrical engineering and the colliery electrician is merely the excuse for its existence. It is all very well to "let this Association in the first place show him the need and then the way to improve himself in matters electrical," but is it going to help him to improve his wages and his status? Is it going to make the position of "colliery engineer" a position of recognised responsibility, one worth having, and therefore one worth studying and training for? Until this is done we cannot see how electricity in mines will ever be rendered absolutely safe and efficient, however stringent the "special rules" may become. On the other hand, its rapid development, and the efficiency necessary for its economical and safe operation, may force the owners to say to the Home Office:—"We must have properly trained engineers for the mechanical side as well as the mining side of our mines, and it is necessary if certificates are insisted upon that one be given to each." Then, and not till then, will there be an end to the accidents and dangers of electricity in mines.

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**Pressure Rises.**

Those who had the pleasure last week of hearing Mr. Duddell, for a second year President of the Institution of Electrical Engineers, discoursing on a subject of which he is a past master, will agree with us that his address constituted a delightful variation from the ordinary run, and recalled to mind his brilliant paper on the arc, of 13 years ago. A striking series of experimental demonstrations accompanied the address, and the fact that not one of them failed to "come off," as experiments are so apt to do, bore testimony to the manipulative skill with which they had been arranged. It is, perhaps, not generally known that the President is a highly skilled horologist, and it was largely owing to this accomplishment that he was able to perfect his oscillograph, as well as the many other instruments with which he has enriched the equipment of the electrical engineer, constructing the apparatus with his own hands—and, of course, brains.

Mr. Duddell disclaimed any pretensions to novelty in the phenomena which he described and illustrated, and doubtless it is true that most of them are dealt with in the voluminous literature on the subject; but it is one thing to know of their occurrence, and quite another thing to have them exhibited and explained in the lucid and entertaining style of an enthusiast, and we are certain that very many of the audience carried away with them entirely new conceptions of the nature and causes of "pressure rises," and of the seemingly insignificant but, in reality, exceedingly important oscillations which are liable to occur when any sudden change takes place in the conditions of an electric circuit. In a later issue we hope to reproduce an abstract of this fascinating address, though, unfortunately, it must necessarily be deprived of half its charm by the lack of the experimental illustrations.

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**The Olympia Motor Show.**

That there is no abatement in the interest shown by the general public in motor-cars, was evidenced by the huge attendance at the annual Motor-Car Exhibition at Olympia, which was brought to a successful conclusion on Saturday last. The show was, as usual, confined to cars of what may be termed the pleasure type, in contradistinction to those of an industrial and commercial nature; and although, also as usual, it was almost entirely a display of petrol cars, there

was, from an electrical point of view, one feature of note—and that was the reappearance of the electromobile.

Although there was only a single vehicle of this type on view, it is an evidence that the great progress which has been made by makers of electric cars in America, coupled with the encouragement given to the movement by central station engineers in the United States, has at last given an impetus in the same direction in this country. So far as the petrol car is concerned, it was noticed that the show is becoming more and more a display of complete vehicles than of chassis, a feature which would seem to indicate that makers are now depending for sales more on the luxury and comfort of the bodywork than on the perfection of the mechanical portion, the name of the manufacturer having to be accepted as sufficient guarantee for the up-to-date character and reliability of the latter. The cars on view ranged from the very popular two-seater to the lordly limousine, the finish and equipment of some of the latter rendering them veritable palaces on wheels. As regards the prices of motor-cars, the position is a curious one, for while one person will say they are lower, another will assert the contrary. The truth is that while, generally speaking, no one particular car can be purchased for a less amount of money than last year, one procures in a 1914 model a much more completely-equipped vehicle for the same money; and as the bulk of the equipment is of necessary fitments that have, in any case, to be purchased, cars may really be said to be somewhat cheaper.

So far as the power generation and transmission plants of automobiles are concerned there is very little new, the improvements being, to use a stock phrase, mainly confined to details, as was pointed out in the Review last week. Had it not been for the electric lighting installations that are now *de rigueur* on all large and costly cars, and the later innovation of electric engine starting arrangements, the Exhibition would have contained little of interest for the technical visitor. As regards the electric lighting systems, the variety of different dynamos is rapidly becoming almost as extensive as that of makes of cars. As we hope to deal with this section of the exhibits more at length in our next issue, it will suffice now to mention that a good deal of ingenuity has been displayed in dealing with the problem of producing a dynamo that shall maintain a constant voltage and output, despite the fact that the motive power is supplied by an internal-combustion engine that is run at an ever-varying rate of speed. As for the other great feature of the show—that of engine starters—some of the problems associated with this new departure were referred to by our special contributor in our last issue. So far only a few British manufacturers have definitely adopted an electric starter as a standard part of the car's equipment. The majority, although willing to fit them when specially ordered, are not yet fully convinced of the reliability of the various arrangements that have been introduced. Indeed, there are some who do not look on the departure with approval, one opinion having been expressed that it is like "using a steam hammer to crack a nut." While it must be admitted that some of the arrangements, from a lay point of view, err somewhat on the side of complication, there is no reason why the majority of the systems, when once their principle of operation is grasped by those motorists who drive their own cars, and also by professional chauffeurs, should not prove successful. In this connection, however, it will be necessary for all makers of electric engine-starters to issue plainly-written books of instruction as to the management and maintenance of their devices, so that they shall not prove failures from want of knowledge in this direction.

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**Copper.** There has been a sharp reactionary movement in the Copper Market since last writing, the main impelling cause of which was, without any doubt, the unsatisfactory position as regards the United States and Mexico, together with the severely reactionary tendency of the share markets both in Wall Street and in Europe. The combined adverse factors in these directions fairly frightened the "bulls" of copper, who, on the publication of the last American copper statistics, threw their holdings overboard in a half panic-stricken mood. It was not that these figures were bad, but that they showed an increase in the United States production of about 3,500 tons on the month, and of a small quantity in the refinery stocks. The output is still well below the highest points attained, but there can be no doubt that a gradual return to normal conditions is in progress throughout the Lake Superior district, and this must tend inevitably in the direction of steadily expanding supplies. It is the fear that this feature, which seems likely to synchronise with declining trade at home and abroad, will result in a considerable surplus of refined copper being accumulated, which instilled apprehension, and the price of the metal was very sharply depressed as a consequence of the realising which followed. No doubt the technical position has been cleared up a good deal by the wholesale selling indulged in during the prevalence of the panicky spirit, and that the market is now very heavily oversold cannot be questioned, but the real position of copper is rather obscure. While the supplies in first hands awaiting disposal cannot be anything but small, and while some of the leading producers are resolutely holding out for their extreme figures, other interests are meeting the demand at substantial concessions, and dealers are cutting in to get all the business they can lay their hands upon. With the last-named category price is not so much a consideration as the booking of orders, for the belief seems to have taken firm root that producers all round will be forced materially to reduce their rates before long if they are to quit output, and on this foundation bear sales of refined are being made. There are no important bull commitments open now, and confidence has been so much disturbed that it is unlikely that any concerted move in this direction will be seen in the near future. While the present uncertainty endures consumers cannot be expected to enter the market with any freedom. In fact, the last few weeks have seen the adoption of a most conservative attitude on their part, the reactionary tendency of the standard copper market naturally imbuing them with a strong sense of caution, and the early restoration of sufficient confidence to warrant the buying of material for forward delivery on anything like a fair basis is most improbable. The trade as a rule is resolved to hold off till such time as the prospects have cleared up, and this cannot be until political and financial considerations have eased down very considerably. The excellence of the entire statistical position has been brought to nought by a persistent series of untoward outside circumstances, but the chances are now in favour of adverse trade and increased production having the controlling power. The strike at the mines of the Rio Tinto property in Spain had little influence upon the market, for although this is the largest European producer, turning out something like 35,000 tons of copper a year, it has to be borne in mind that this output consists very largely of copper values rather than copper, and that the copper market as such has, therefore, not been much affected. The American trade in acid and other products of the cupriferous pyrites which the Rio Tinto Co. ship in huge quantities across the Atlantic, is, however, likely to be affected by the temporary suspension of supplies. The outlook for copper is for a rather quiet market with fluctuations, but for a long view the direction of prices is distinctly towards a lower level.

The last European statistics issued this week made quite a good showing disclosing as they did a further contraction in the stocks and in the visible supply, but they passed unnoticed. The feature has been the heavy premium which has developed on cash and near deliveries, and which fully bears out what has been said above, as to the extent of the oversold account. The premium is, however, a wholly disconcerting element, for it breeds additional distrust, and renders thereby the activities of buyers, both consumers and speculators, even more restrained than before. What is really wanted is a quiescent market for a few weeks, so that fresh bearings can be taken. At the moment there is an atmosphere of distrust which overpowers everything.

## ELECTRICAL ACCIDENTS IN MINES.

(*Concluded from page* 804.)

There were no electrical accidents in No. 5 (Manchester and Ireland) District, and only one non-fatal accident in No. 6 (Liverpool and North Wales) District, but no particulars are given. In No. 7 District (South Wales) there were two non-fatal accidents underground, and one fatal and eight non-fatal accidents on the surface.

One of the underground accidents occurred at Albion Colliery (Glam.) on May 24th; the electrician received a shock while replacing the terminals of the controller of a hauling engine, and was only resuscitated after 20 minutes' artificial respiration by ambulance men. He said he had cut the current off, and it was supposed it might have been put on again by a man working near the switchbox; the current was at 440 volts pressure. The other was at Britannia Colliery on July 1st. A pump man was slightly burned by a flash caused by a fault on the starter transformer of a pump-motor working at 3,000 volts.

The fatal accident on the surface occurred at Gellihir Colliery on December 4th, when an electrician received a fatal shock while disconnecting the cable from the generator from a cable on a drum used for lowering a pump in the mine. He had either neglected to cut the current off, or, having done so, it had been switched on again by some person. The earthing of the cable was also defective. The voltage was 550, three-phase.

In No. 8 (Midland and Southern Counties) District there were two fatal and three non-fatal accidents. The two fatal accidents were underground, and are described as follows:—

In the first accident the deceased had taken charge of a coal-cutting machine worked by 500-volt, three-phase alternating current. The machine was temporarily stopped while its haulage rope was being extended for attachment to a newly-set prop, and while handling the rope the deceased received an electric shock which caused his death before he could be released. The machine was connected to the gateway switch by means of an unearthed trailing cable. On examination, it was found that the set-pin of one of the terminals in the plug-box of the machine had become loose, and had slacked back, so that its head was in contact with the body of the machine; consequently, it was "live" throughout, including the rope from which deceased received the fatal shock. By deceased's instructions this trailing cable had been loaded into a tub and labelled to go to the surface two days previously, and it should not have been in use; an earthed trailing cable was available for use, but it was a considerable distance away, and needed to be coiled up and placed in a tub before it could be fitted. Deceased probably was in a hurry to finish a "cut," and therefore brought the defective cable into use again to save time.

In the other case, deceased was superintending the re-erection of a steel girder for a roof support. One end of the girder was resting on a post, the other end was on the floor, and in that inclined position it pressed heavily on two insulated lighting wires carrying electric current at 550 volts, and cut through the insulation. While assisting two other men to lift the lower end of the girder, the deceased, who was standing upon an iron plate in contact with moist ground, received an electric shock which killed him instantly. The deceased should have seen that the current was switched off the circuit, according to the regulations of the colliery, before attempting to fix a roof support in the neighbourhood of the electric wires.

Of these the Inspector says: "It is obvious that neither of them should have occurred." We quite agree that in both cases there was some degree of carelessness on the part of the workmen, especially in regard to the latter, but what sort of a set-pin was it in the plug box which could so easily slack back? and surely the "electrician" should have seen that the cable was sent out of the pit if it was not fit to use.

Another accident which might have been much more serious occurred at West Cannock Colliery, South Staffordshire, by which a man received a slight shock, and a horse, which stood about 1,500 yards further in-bye, was killed. The current used was three-phase alternating, 650 volts, 50 periods per second. It was conveyed from the generator on the surface to a distributing station near the shaft bottom by an armoured cable, but from this point for a distance of 920 yards the cable was unarmoured. Beyond this for a further distance of 1,115 yards the cable was armoured. The metallic covers, motor frames, &c., were earthed to the surface through the cable armouring where available, but for the above 920 yards the earth connection was made by means of an old haulage rope $\frac{3}{4}$ in. in diameter, laid under the rails. The armouring of the shaft cable was connected at the surface by means of a similar rope 40 yards in length to two copper plates in wet clayey ground. The connections between this rope and the earth plates had been made by wire lacings, and were subsequently found to be loose and therefore defective. One arm of a three-throw switch had shorted on to the frame through a hard fibre tube on which the knife blades were mounted, the earthing rope fused at a corroded part near to which the man was standing with his feet upon the rope and his arms resting upon the unarmoured cable, and he received a shock which caused him to fall, but he was not burnt or otherwise injured. The horse which was standing on the rope 1,500 yards further in-bye was killed instantly. Tests had been made by the attendant in the generating house at 7 and 7.30 a.m. on the morning of the accident, but no indications of leakage were discovered.

The accident emphasises the great danger attending the use as earth conductors of old wire ropes which are worn, corroded or of insufficient size, and the necessity of making all connections efficiently, to secure electrical continuity. The old ropes in this case were at once cut out and copper conductors substituted, that on the surface being properly soldered and riveted to the earth plates.

Again, we might ask, Who was the *competent* electrician? and what training had he? and one might also ask whether he was a member of the A.M.E.E., or whether he held a certificate granted by this Association?

An alarming explosion occurred at Auckland Park Colliery in Durham about 2 a.m. on Sunday, October 27th, 1912, in the "Harvey" seam, to which the damage was practically confined. It was a very remarkable circumstance, inasmuch as *no one was in this seam* at the time of the explosion—which was also most fortunate—and the few persons in other parts of the mine were got out without experiencing any ill effects. The damage done was very considerable, and a separate report by Mr. R. A. S. Redmayne, H.M. Chief Inspector of Mines, and Mr. Nicholson, was only recently issued.

There was a current belief at the time of the explosion that it was due to electricity, and on this point the report says: "At an early stage of the investigations the electric cable in the Harvey seam was looked upon with suspicion, as a very probable cause of the explosion, and when it was found that one of the three cores was faulty, this suspicion was intensified." It was found, however, that the fault had been caused by the explosion, and was due to a large fall of roof, which, strangely enough, had driven the cable on to an iron spike, so that it penetrated the armouring and came in contact with one of the cores. A microscopic examination failed to show the "slightest sign of burning or arcing, and it was quite evident that . . . the spike had entered the cable after the current had been cut off." It was then suggested that it might have been caused by a joint box, on account of an incident that occurred at the Black Boy Colliery adjoining. "One morning . . . . the fore-shift men at this colliery were walking in-bye, when they saw a sudden burst of flame from a joint box." An examination of the box showed that there was a small hole at one side of the filler cap, but whether it had been there before the burst or was caused by it was not determined. The roof immediately above the hole was spluttered with bituminous compound, and a large sooty streak extended from the box right across the roof of the roadway. . . . On the box . . . . being opened it was found that the cause of the breakdown *was a loose terminal screw*. Very little bitumen had been lost and *there was no sign of arcing on the terminals*. . . . . The cause of the flashing . . . . was afterwards found to have been the result of some water from a three-way tap in

a motor house being accidentally allowed to impinge on a live lead at a switchboard. This caused a dead earth and a sudden rise in pressure, which found vent at the joint-box." We may here remark that this is not the first time that trouble, which might easily have resulted in serious accidents, has been met with in joint-boxes filled with bitumen, from the same cause. Apparently people will not remember that a joint is the weakest link in an electric circuit, and that, as it cannot be soldered, a large surface ought to be allowed for the connection, to reduce the current density much below that allowed for the solid cable, and that all bolts and nuts must be so made that they *cannot possibly come loose*. It is just as important as a high-pressure steam main, which must be tight and the bolts of which never work loose. The report continues:—"If flashing such as took place in the landing at Black Boy on a long-wall road, where there was little or no coal dust, had occurred at the joint-box on the main engine plane at Auckland Park, *there would have been little difficulty in accounting for the explosion.*" As it was, however, proved that nothing was wrong with the joint-box at Auckland Park, it was unquestionable that whatever else might have been the cause it *was not electricity.*

Mr. Nicholson, in his annual report, mentioned that "two fires were due to short-circuits and arcing in South Durham coal mines"; no details are given as to how the short-circuits occurred, but they point to the necessity of careful workmanship and supervision by competent and able engineers to prevent these occurrences, and not depending upon a man who gets labourer's wages and has no electrical or engineering training, to carry out the Home Office rules and regulations, even if he be armed with a written appointment by the colliery manager. The employment of competent men would be the means of reducing accidents and risk of accident, and the suggestion of the Inspectors "that all joint boxes should be securely built in with brickwork and well-filled with sand" would be unnecessary, as it is already unreasonable. This sort of thing only wants carrying a little further, when the cost of special work, due to rules and regulations, and merely to guard against crass ignorance and pure incompetence, on installing electricity will be so great that it will become prohibitive.

## CORRESPONDENCE.

*Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Diesel Engines.

I have read with interest the articles that have appeared from time to time in the ELECTRICAL REVIEW, and, in my humble opinion, you are suffering from a bad attack of "nerves."

You will have noticed that none of the engine builders are likely to get killed in the rush to put a reflux valve on the market, and also that they are very backward in even publicly discussing such a valve.

The Bray engine is a single-cylinder engine—would you advocate putting three such valves on a three-cylinder set? And if you put this valve on the blast pipe, why not a check valve on the fuel pipe?

Also why not an oil and moisture absorber on the H.P. delivery from the compressor? In one station, I understand, the stand-by boilers are fired by the exhaust gases from their Diesel engine, so that on your line of argument they ought to have a reflux valve on the exhaust pipe to stop a flash back to the cylinder *viâ* a bad-fitting exhaust valve.

The Diesel engine requires simplifying not complicating.

The Diesel engine is not the wild untamed animal you would have your readers believe, but like boilers, engines, and gas plants will bite if not treated with the common attention all such plants require.

The majority of the accidents tabulated by Mr. Taylor are due to wear and tear, which, I believe, occurs in other prime movers and has been the cause of fatal accidents.

Of Mr. Taylor's recommendations only Nos. 5 and 6 appeal to me, and I hope that before the Home Office put in force any regulations they will submit the draft to all users of Diesel engines and hold an open inquiry to hear objections. A blast pressure recorder would be of service, and I should be glad to receive particulars and prices from makers of such instruments. Trusting you will soon recover—

**C. J. Wood.**

Sale U.D.C. Electricity Works,
*November* 17*th*, 1913.

[We have again read our editorial of last week on this subject, but we quite fail to detect any ground for our correspondent's suggestion that we are in a state of panic. The advantages of the Diesel engine have been frequently dwelt on in our columns; surely it is permitted to us to comment on its drawbacks also, and to point out a means of doing away with one of them? One reflux valve to each blast vessel would suffice, and as this was the whole extent of our proposal, our correspondent's derisive additions need not be discussed.—EDS. ELEC. REV.]

### Wind-Power Electric Plant.

My attention has been drawn to an extract of the paper on "Wind-power for the Generation of Electrical Energy" (read by me before the Electrical Association of N.S.W.), which was printed in your issue of August 8th. The form of the abstract does not appear to me to do justice either to the paper or to the other forms of electro-windmill apparatus described therein; for that reason I am writing to you, as you apparently have not been furnished with a full copy of the paper.

I am forwarding a galley-print copy under separate cover, and if you will kindly peruse this you will see that, although I have been careful to do justice to the Childs patent apparatus, I have drawn particular attention to other plants of a more economical type, and therefore more commercially practicable.

I have made special reference, amongst others, to the apparatus invented by Mr. Turnbull, which I have every reason to believe has successfully solved, as stated in the paper, the commercial problem involved, and which, in the plants so far constructed and in operation in N.S.W., has given the utmost satisfaction. It is as well, perhaps, to add, that I have no pecuniary interest in any electro-windmill concern, but feel that the efforts of a fellow-Australian deserve more recognition than in this instance has been given.

**W. H. Myers, B.E. (Syd.),**
*Vice-President, Elec. Assoc. of N.S.W.*

Sydney, *October* 7*th*, 1913.

P.S.—You will also see, from the copy forwarded, that one of the wind-velocity figures given in your abstract is not quite correct. The average wind velocity for the month giving the *minimum total wind-miles* in Sydney is 8·8 miles per hour; this indicates a more favourable condition for windmill operation than that stated in the abstract.

[We had the full text of the paper before us, and the only modern plant described in it was the one to which our abstract related. The references to Mr. Turnbull's system, so far as we can identify them, are comprised within a dozen lines, and the author expressly refrains from describing the system, though apparently it was shown to the audience by means of lantern slides.

We regret that our abstract failed to indicate that the average wind-velocity given for Sydney related to the month in which the minimum average occurred.—EDS. ELEC. REV.]

### Electric Clocks.

It is true that Mr. G. B. Bowell's name was associated with mine in the patents of 1895 and 1897, but I think it would have been kinder of his brother not to have claimed for him even reflected glory from his early association with the "Synchronome" system, as it calls for comments which I have never yet made, and which I hoped to have avoided altogether.

It is always futile to discuss which of two joint inventors had most to do with the genesis of an idea. Applying the

judgment of Solomon, it was Mr. Bowell who abandoned the babe shortly after its birth, and willed its slaughter. He has had nothing to do with it since 1898, and took no interest in the Institution papers on the subject in 1899 and 1910. The system as it stands to-day has been created and commercially established, in spite of him and not with his assistance. Facts speak louder than words; and it is surely inconsistent for his brother to claim for him a share in the elucidation of the principles of electric time service, which he has habitually transgressed, presumably in the honest belief that they are erroneous or unimportant.

**F. Hope-Jones, M.I.E.E.**

Clerkenwell, *November 18th*, 1913.

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**Remarkable Motor Records.**

Referring to your interesting article under the above heading in your issue of October 10th, I think you will find that the motors do not develop 120 B.H.P. at 230 R.P.M. They would develop this output at maximum speed, *i.e.*, 650 R.P.M., and at lower speeds the B.H.P. would be proportionately reduced. Even so, the records are sufficiently remarkable.

**Sigma.**

Calcutta, *October 30th*, 1913.

[When our correspondent receives our issue of last week, he will see that the field strength at 230 R.P.M. is more than three times as strong as at 650 R.P.M. Consequently, the full output can be obtained at both speeds.—EDS. ELEC. REV.]

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In my letter of last week, referring to this matter, I gave the starting current as 50 amperes, but find upon inquiry that it is only 16 amperes.

The current taken to run the motor light at lowest speed is 6 amperes, therefore only 10 amperes are required to start up through the gearing.

**H. Chitty.**

London, N.

## TRADE STATISTICS OF THE STRAITS SETTLEMENTS, 1912.

THE following statement showing the imports of electrical and other materials into the various Straits Settlement ports in 1912, is taken from the recently compiled trade statistics. The figures for 1911 are given for the purposes of comparison and notes of any increases or decreases have been added.

IMPORTS INTO SINGAPORE.

| | 1911. Dollars. | 1912. Dollars. | Inc. or dec. Dollars. |
|---|---|---|---|
| *Telegraph and telephone materials.*— | | | |
| From United Kingdom | 123,000 | 245,000 | + 122,000 |
| ,, Belgium ... | 39,000 | 6,000 | — 33,000 |
| ,, Germany ... | 28,000 | — | — 28,000 |
| ,, France ... ... | — | 27,000 | + 27,000 |
| ,, Other countries ... | 9,000 | 10,000 | + 1,000 |
| Total ... | 199,000 | 288,000 | + 89,000 |
| *Tramway and railway materials.*— | | | |
| From Belgium ... | 21,000 | 34,000 | + 13,000 |
| ,, Germany ... | 1,000 | 11,000 | + 10,000 |
| ,, United Kingdom | 102,000 | 68,000 | — 34,000 |
| ,, Other countries | 2,000 | — | — 2,000 |
| Total ... | 126,000 | 113,000 | — 13,000 |
| *Electrical machinery.*— | | | |
| From United Kingdom | 181,000 | 210,000 | + 29,000 |
| ,, Germany ... | 14,000 | 39,000 | + 25,000 |
| ,, Italy ... ... | 11,000 | 17,000 | + 6,000 |
| ,, Belgium ... | 6,000 | 1,000 | — 5,000 |
| ,, United States ... | 4,000 | 1,000 | — 3,000 |
| ,, Other countries | 20,000 | 29,000* | + 9,000 |
| Total ... | 236,000 | 297,000 | + 61,000 |
| *Engines, boilers and parts.*— | | | |
| From United Kingdom | 330,000 | 220,000 | — 110,000 |
| ,, Germany ... | 11,000 | 2,000 | — 9,000 |
| ,, Netherlands ... | 20,000 | — | — 20,000 |
| ,, United States ... | 12,000 | 10,000 | — 2,000 |
| ,, Other countries | 45,000 | 24,000 | — 21,000 |
| Total ... | 418,000 | 256,000 | — 162,000 |
| *Machinery, other (except sewing machines).*— | | | |
| From United Kingdom | 686,000 | 649,000 | — 37,000 |
| ,, Australia ... | 18,000 | 8,000 | — 10,000 |
| ,, Germany ... | 26,000 | 48,000 | + 22,000 |
| ,, United States ... | 83,000 | 79,000 | — 4,000 |
| ,, Other countries | 66,000 | 129,000† | + 63,000 |
| Total ... | 879,000 | 913,000 | + 34,000 |
| *Lamps and lampware.* | | | |
| From Belgium ... | 6,000 | 3,000 | — 3,000 |
| ,, Germany ... | 238,000 | 186,000 | — 52,000 |
| ,, United Kingdom | 148,000 | 128,000 | — 20,000 |
| ,, United States ... | 12,000 | 16,000 | + 4,000 |
| ,, Other countries | 32,000 | 57,000‡ | + 25,000 |
| Total ... | 436,000 | 390,000 | — 46,000 |

*Japan, 10,000 dollars.

†Belgium, 32,000 dollars; Holland, 10,000 dollars.

‡Austria, 31,000 dollars.

IMPORTS INTO PENANG.

| | 1911. Dollars. | 1912. Dollars. | Inc. or dec. Dollars. |
|---|---|---|---|
| *Electrical machinery.*— | | | |
| From United Kingdom | 56,000 | 66,000 | + 10,000 |
| ,, Germany ... | 39,000 | 38,000 | — 1,000 |
| ,, Other countries | 7,000 | 6,000 | — 1,000 |
| Total ... | 102,000 | 110,000 | + 8,000 |
| *Engines, boilers and parts.*— | | | |
| From United Kingdom | 429,000 | 679,000 | + 250,000 |
| ,, Germany ... | 38,000 | 33,000 | — 5,000 |
| ,, Belgium ... | 8,000 | 12,000 | + 4,000 |
| ,, United States ... | 22,000 | 6,000 | — 16,000 |
| ,, Other countries | 21,000 | 31,000 | + 10,000 |
| Total ... | 518,000 | 761,000 | + 243,000 |
| *Machinery, other (except sewing machines).*— | | | |
| From United Kingdom | 54,000 | 36,000 | — 18,000 |
| ,, Belgium ... | 4,000 | 3,000 | — 1,000 |
| ,, Germany ... | 3,000 | 6,000 | + 3,000 |
| ,, Other countries | 10,000 | 3,000 | — 7,000 |
| Total ... | 71,000 | 48,000 | — 23,000 |
| *Lamps and lampware.* | | | |
| From Austria ... | — | 1,000 | + 1,000 |
| ,, Belgium ... | 3,000 | 4,000 | + 1,000 |
| ,, Germany ... | 47,000 | 56,000 | + 9,000 |
| ,, United Kingdom | 61,000 | 81,000 | + 20,000 |
| ,, Other countries | 7,000 | 7,000 | — |
| Total ... | 118,000 | 149,000 | + 31,000 |
| *Telegraph and telephone materials.*— | | | |
| From United Kingdom | 23,000 | 40,000 | + 17,000 |
| ,, Other countries | 3,000 | 2,000 | — 1,000 |
| Total ... | 26,000 | 42,000 | + 16,000 |
| *Tramway and railway materials.*— | | | |
| From United Kingdom | 6,000 | 2,000 | — 4,000 |
| ,, Belgium ... | — | 10,000 | + 10,000 |
| Total ... | 6,000 | 12,000 | + 6,000 |

IMPORTS INTO MALACCA.

| | 1911. Dollars. | 1912. Dollars. | Inc. or dec. Dollars. |
|---|---|---|---|
| *Telegraph and telephone materials.*— | | | |
| From United Kingdom | 2,000 | 1,000 | — 1,000 |
| ,, Other countries | — | — | — |
| Total ... | 2,000 | 1,000 | — 1,000 |
| *Electrical machinery.*— | | | |
| From United Kingdom | 1,000 | — | — 1,000 |
| *Engines, boilers and parts.*— | | | |
| From United Kingdom | 1,000 | 4,000 | + 3,000 |
| *Machinery, other (except sewing machines).*— | | | |
| From United Kingdom | 34,000 | 15,000 | — 19,000 |
| ,, Other countries | 20,000 | 9,000 | — 11,000 |
| Total ... | 54,000 | 24,000 | — 30,000 |
| *Lamps and lampware.* | | | |
| From United Kingdom | 2,000 | 1,000 | — 1,000 |

N.B.—Dollar = 2s. 4d.

## ADJUSTABLE SPEED ALTERNATING-CURRENT MOTORS FOR PRINTING PRESS WORK.

Those who follow the progress of the alternating-current motor closely, have been aware, for some years, that it was theoretically possible to produce an alternating-current commutator motor having the same characteristics as the direct-current shunt-wound motor—namely, a speed which is adjustable and at the same time independent of the load; but it will come probably as a surprise to the average user of alternating-current motors that such a motor exists, and is capable of as wide a field of application as the similar direct-current motor, many thousands of which are put into service every year.

The present article describes one only of the many possible applications of this type of machine—namely, the application to printing press work.

The machine may be used either on single or polyphase circuits, its advantages being particularly marked on single-phase circuits, since on such a circuit no satisfactory printing press motor has hitherto existed, even for running at a single speed; in order,

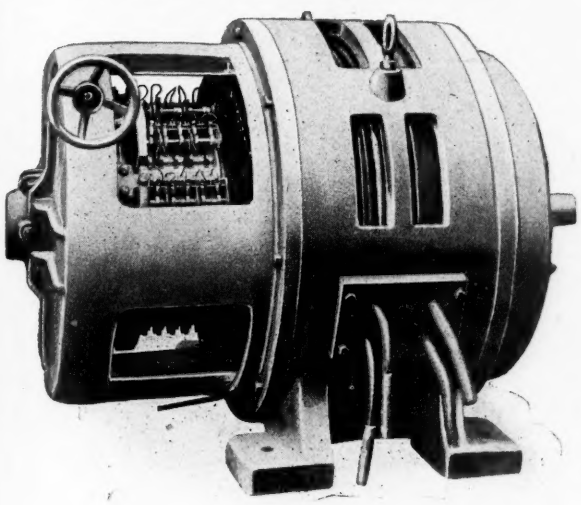


Fig. 1.

therefore, to show the motor operating under the most difficult conditions, we may refer to a single-phase installation recently completed at the works of Messrs. Harrison & Sons, Printers in Ordinary to His Majesty, at Hayes, Middlesex.

Before describing this installation, it may be of interest to give some particulars of the motor, its construction and general performance.

The motor, which is built under the Punga & Creedy patents, and is being placed on the market by Messrs. F. Parkinson & Co., of Leeds, is shown in fig. 1.

The stator consists of a cast-iron frame which forms the base of the motor and also supports the bearing brackets; this frame carries the laminated-iron stator core which is of the usual induction-motor type and contains a number of semi-closed slots, in which the single-phase stator winding lies.

The rotor consists of a laminated-iron core mounted on a strong cast-iron spider and carrying a drum winding, similar to

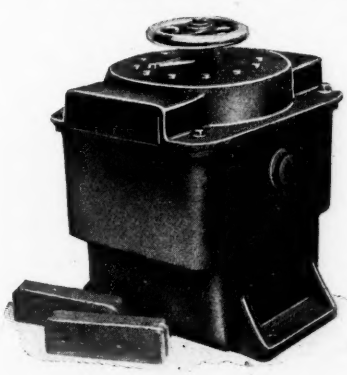


Fig. 2.

that of a direct-current machine, and connected to a commutator, built up of hard-drawn copper bars, insulated by means of pure mica.

The brush holders are of standard design, containing carbon brushes, in every way similar to those of a direct-current machine.

The standard machine is fitted with ball-bearings, in order to reduce the friction and lessen the necessity for frequent attention; these bearings are of the best quality obtainable, liberally designed for the whole range of outputs and so arranged as to be absolutely dust-proof.

Printing press work requires, in addition to the motor, a speed regulating controller and a starting switch, arranged so as to permit of "inching" and capable of being fixed in any desired position on the press; the speed regulation is effected by means of an ordinary dial-type controller, having in standard designs, 10 stops, corresponding to the 10 different speeds.

The contacts are arranged to run under oil, whereby sparking and burning is absolutely prevented, and it is found in practice that such controllers, though in constant use, show no signs of wear on the contacts. A view of this controller is given in fig. 2.

The starting switch can be arranged in two different manners, according to whether a remote control is used or not. The most usual arrangement shown in the view, is that corresponding to a direct control, the use of intermediate solenoids, in this case, being avoided. A small drum-type controller is fitted on the printing press, as shown, the contacts running in oil for the purpose mentioned above.

A notable characteristic of this type of motor is the absence of starting resistance of any kind, it being standard practice to throw the motor direct on the line, whereupon it can be arranged to absorb not more than twice full-load current, and will give a starting torque of from 2 to 2½ times full-load torque. By means of this drum-type controller it is possible to "inch" the printing press with exactly the same ease and accuracy as in the case of a direct-current motor, a result which is unique on single-phase current. Of course, no counter shaft with fast and loose pulleys is required, the motor being belted or geared direct to the printing press.

A number of small knife switches may be fitted in series at various points on the press to enable the operator to stop the

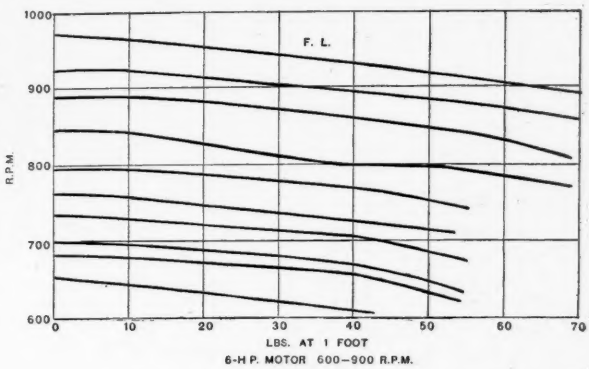



Fig. 3.

apparatus from wherever he stands. In the case of remote control, the control is effected by means of a small pilot switch exactly the same in every respect as that used with a direct-current installation.

Figs. 3, 4 and 5, show the speed-torque curves and the efficiency and power-factor curves of the machine from half load to 33 per cent. overload. on single-phase current; it will be seen that the efficiency is fully equal to that of a direct-current motor, and

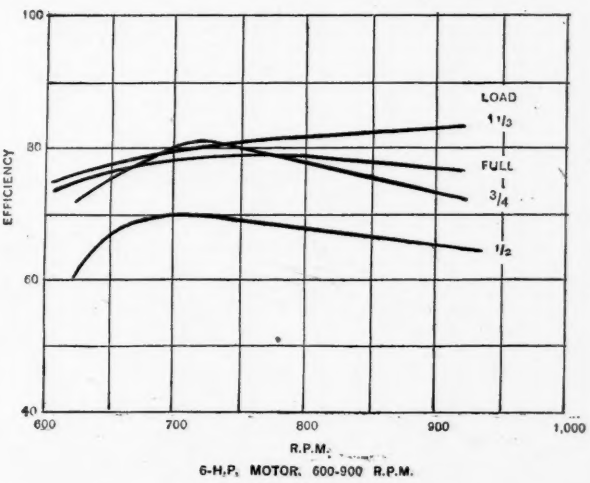



Fig. 4.

remains approximately the same for the full-speed range, there being, perhaps, a slight drop at the lowest speeds.

Another unique feature of this type of motor is its extremely high power-factor, which will appeal more especially to central station engineers. It will be seen from the curves that the power

factor at full load averages 95 per cent. over the entire range of speed. From the users' point of view, this means that whereas other alternating-current motors take from 20 to 25 per cent. more current than a direct-current motor does to do the same work, even when the efficiency is the same in both cases, the motor described takes about the same current only, and consequently enables a certain economy in wiring to be realised.

There is no need to enlarge on the importance of high power-factor to the central station man; if all the motors on the average alternating-current circuit had as high a power-factor as the motor for which curves are shown, it would be possible to carry the load with about 25 per cent. less plant; or, in other words, carry a 25 per cent. greater load with the same plant.

Fig. 3 shows the speed-torque characteristics of the motor. It will be seen that the speed drop between no load and full load is very slight, amounting to 3 per cent. only, which is certainly no more than that of the average direct-current motor.

On the whole, therefore, the makers feel fully justified in their claim that their alternating-current printing-press motor is equal in every respect to the standard direct-current motor used for the

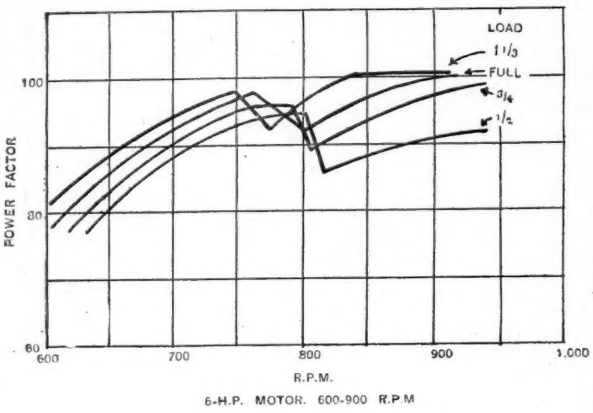



FIG. 5.

same work, while, in some respects, it is superior. It may be added that the commutation of this machine is claimed to be quite equal to that of a direct-current motor, as it runs on full load without any trace of sparking.

On account of the necessity of using a variable-speed motor and the fact that it has hitherto been impossible to obtain one to operate on alternating currents, a very common method of equipping printing establishments, situated in a district where alternating-current supply exists, is to install a motor-generator set, and the presses are then equipped with standard direct-current motors in the usual way; this has serious disadvantages in high first cost and low efficiency. The high first cost renders it out of the reach of all but establishments of considerable magnitude, and the net result is that small establishments are unable to take advantage of the variable-speed drive at all, if they are situated in an alternating-current district, while if this district is single phase they are worse off still, as the use of a countershaft to permit the motors to start on no load becomes essential. "Inching" by means of the motor often becomes a difficult operation, so much so that the presses often have to be pulled round by hand, which is, to put it mildly, a nuisance.

But the effects of the low efficiency of the motor-generator drive are still more serious. Let us consider the case of operation of a direct-current motor, operated through a motor-generator drive, as compared with an alternating-current motor, of equal efficiency, operating direct from the line; assume a very common price of 1d. a unit for electrical energy. Take a standard 6-H.P. motor, operating 48 hours a week, at an efficiency of 80 per cent., it will consume approximately 270 units a week on full load, or 3,510 a quarter of 13 weeks, costing nearly £14 13s. 4d. Now, if we have a motor-generator set feeding the motor, and we assume 90 per cent. efficiency for the large motor, and 90 per cent. for the generator, the overall efficiency of the set at full load will be only 81 per cent., about the same as that of the small motor. The power consumption will, therefore, be multiplied in the ratio of 100 to 81, or instead of the energy costing £14 13s. 4d., it will cost £18 2s. Hence by the elimination of the motor-generator set we save £3 8s. 8d. every quarter on a single motor. The efficiencies given above for the motor-generator set assume that it is fully loaded all the while, but this is far from being the case. Such a machine usually feeds a considerable number of motors, and if some of these motors are not running, the set will be only partially loaded, and this overall efficiency, instead of being 81 per cent. may fall to from 65 to 75 per cent., whereupon still worse results, as regards cost, are obtained.

**Standardisation of Plugs.**—The question of the standardisation of two-pin plugs and other small appliances in common use by the general public, was brought up for consideration at the Council meeting of the I.M.E.A. held on the 14th inst., and a sub-committee was formed to deal with this matter, Mr. A. C. Cramb, of Croydon, being appointed honorary secretary.

## THE TRADE OUTLOOK IN CANADA.

WE reproduce the following interesting review of the prevailing trade position in Canada, and the factors likely to influence the course of business next year, from our esteemed contemporary, the *Canadian Electrical News*:—

Whether or not the year 1914 will be an active period for us industrially, depends, in the main, on two factors: (1) the natural demand for manufactured products, and (2) our financial ability to purchase these products. Without question there is only one answer to the first. Canada's capacity for almost unlimited development is established beyond the shadow of a doubt, so that our manufacturers may be assured of an ever-increasing demand for practically every class of manufactured articles. It remains then to discuss only the ability of Canadians as individuals, municipalities or private companies to provide the purchase price. During the past summer, tight money has been a very real obstacle in the way of certain lines of activity. This condition was brought about partly by the unusual requirements of the European continent; also to a considerable extent by the amount of money that had become tied up in realty investments from one end of the Dominion to the other; but these conditions were intensified by the conservative, ultra-conservative we believe, attitude of our banks. Arguing that the signs foreshadowed a repetition of the crisis of 1907 and similar previous periods, and believing that prompt action would save the situation, they have followed the policy, apparently quite consistently, of lending no money which, as they thought, could by any possible chance be used to encourage the general extravagance to which Canadians were rapidly becoming habituated — the result largely of a number of years of unusual prosperity and plentiful money which had turned the heads of a large percentage of our citizens. This action of the banks has caused a great deal of discomfort to even their most deserving customers, and while it is generally conceded that caution, in reason, was the wisest course that could have been followed, it appears to us that the banks, by taking the extreme course, have unnecessarily curtailed the circulation of money, and have done much towards producing the very condition —a trade reaction—they sought to prevent. Just how far their course was justified is difficult to determine, and it has undoubtedly placed the banks in a sound position, so that at no time have they had to refuse assistance for developments which, in their own judgment, they have considered necessary. As a result, the larger industrial life of the country has not suffered seriously, nor is there any sign of it in the future, for want of sufficient capital. Certain industries report the biggest year's business in their history.

As already indicated, the extent of the demands to be made on our factories during the next 12 months will depend on the amount of money in the hands of (1) the individuals, (2) municipalities and (3) private corporations. Our recent bountiful harvest has been an all-important circumstance, which will mean that the general public is pretty well supplied with ready money. The farmer only knows through the newspapers that money is scarce. As a result, the small retailer of general supplies—such as hardware, boots and shoes, &c.—except in the larger centres, will probably not experience any diminution in trade; this means continued prosperity for the wholesale dealer and manufacturer. In the building industry, is it not a fact that practically every city and town in Canada is under-supplied with both public and residence buildings, and the population still continues to increase at a rapid rate? While building permits issued during the last month or two indicate a slackening in this line of trade, this, we think, is explained in large measure by the very general feeling that both workmen and supplies will be obtainable at lower rates; also, due to tight money, a certain number of sacrifices have been thrown on the market. We see no sign of a diminished demand, however, and this slight reaction will just mean an increased activity in building trades of all kinds as soon as the money situation has readjusted itself. With an already inadequate supply of buildings, an ever-increasing population, and a fair distribution of money among the middle classes, the demand for all kinds of building materials seems assured.

With the larger municipalities and private corporations the outlook may not be so entirely optimistic. These have found it necessary, often, to go outside of Canada for their supply of money, which has not been so readily forthcoming during the last few months, on account of similar demands from other sources. Canada's natural resources, however, constitute a splendid security, which stands behind all her industrial undertakings, and we are confident that, even in a world competition, she can obtain the necessary supply of capital; perhaps, just at this time, at a little higher rate, but not so high that the resultant developments will not amply justify the increased cost.

And after all has been said on both sides, Canada's immediate and ultimate prosperity is inseparably tied up with the prosperity of her great rural population, which, at the present moment, is possibly not equalled in any other country in the world. Our crops, just harvested, will put into the pockets of the farmers during the next few months in the neighbourhood of $300,000,000. This will soon find its way through the usual channels to the manufacturers. To this sum might be added dividends from investments which are being distributed to the general public at the annual rate of something over $150,000,000. This will also indirectly reach the manufacturer. The extent to which the natural frugality of the average citizen will assist in the readjustment of conditions is, of course, difficult to determine in dollars and cents, but there is no doubt that at a time like the present a general policy of curtailment is being followed by most of us, and

these accumulations will be ready for circulation as soon as the general public judges the opportune moment has arrived.

Summing up the situation, while we anticipate that difficulties will continue to be encountered for some time in obtaining large sums of money abroad, this condition, we believe, will be more than offset by favourable local factors, of which we may mention :—

1. The unsatisfied demand for every kind of manufactured product.
2. The unexampled prosperity of our great rural population.
3. The good security and high returns of Canadian investments, which means ability to borrow abroad.
4. The present low conditions of stock supply ; it is generally conceded that the retailer is running very low, following the general policy of caution.

## A TWO-RATE TARIFF SYSTEM WITHOUT TIME-OPERATED CONTROL.

By H. H. Perry, M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers, *at Manchester, November 18th*, 1913.)

It seems ridiculous to charge at certain times of the day a low rate for power and another rate for lighting for the dual supply, and further, it is equally absurd to exact the full penalty price from a consumer when he is using only a fraction of his maximum lighting load, assuming for the moment that no heating is in use.

The object of this paper is to show :—

1. That the use of electricity can be extended, with advantage both to supplier and consumer, by granting facilities to the latter for using his lighting circuits during "off-peak" hours at a low-rate charge ; and

2. That the multiplication of domestic power circuits, while being an advantage, is not always necessary for securing a low-rate charge.

A simple change-over switch, automatically rocked, can combine or separate the two rates at will. Such a method needs two meters, and therefore resolves itself into a two-rate system.

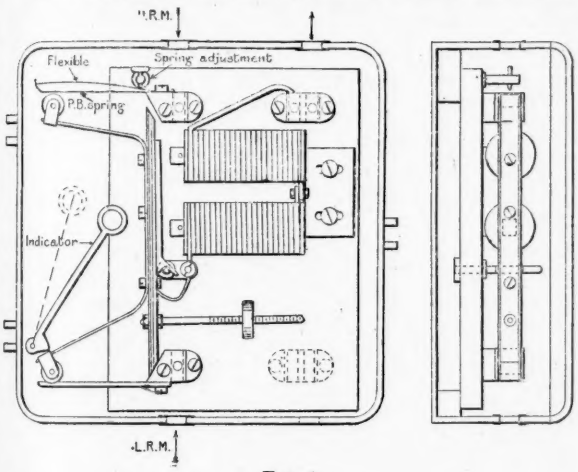



Fig. 1.

But why go to expense in order to change a consumer's meter over from the high rate to the low rate, when a magnetic change-over switch will automatically do this ?

As shown in fig. 1, an ordinary single-pole change-over switch is employed, one arm of which is magnetically attracted by the lighting-circuit magnetising current. It is freely pivoted about its centre, and a balance weight is provided on the other arm, the position of which is adjusted to give any proportion of the consumer's lighting between, say, 5 per cent. and 25 per cent. at the low rate. In isolated cases it may be practicable to give a higher percentage.

Auxiliary contacts are provided for maintaining continuity of the circuit when changing over ; without these, the practical every-day working of the switch would be impossible. No mercury cups are used.

Demagnetising turns on the magnet, or a separate counter-magnet, are provided for the purposes to be described in connection with fig. 4.

The switch is normally on the low-rate side, and two of the ordinary stock pattern of meters are employed, a practice which is daily becoming more common for domestic circuits owing to the demand for power.

The connections shown in fig. 2 would be used for a consumer taking practically all his current for lighting, no separate circuit being provided.

All the current passes through the high-rate meter (H.R.M.) or the low-rate meter (L.R.M.), and the switch is adjusted by the balance weight or by the air-gap so that all currents less than a given fraction of the maximum current (5-25 per cent.) are registered on the low-rate meter.

Fig. 3.—A separate power circuit is used, connected to the switch as shown, and two meters are therefore necessary under ordinary tariff conditions. The low-rate meter (L.R.M.) will therefore register the whole of the power load, and up to 25 per cent. of that required by the lighting, when the switch is on the low (or left-hand) side. When the switch is on the high (or right-hand) side, L.R.M. will meter the power only, and H.R.M. only the lighting. Both in this case and in fig. 4 the meters are required to operate simultaneously.

Fig. 4.—The consumer has the option of these connections provided certain heating apparatus, such as a complete cooker, a system of radiators, or other power, is adopted, whether purchased outright or hired.

So long as the heater system is in use, L.R.M. will meter all power and any desired proportion of the lighting, since the pull of the magnet is neutralised to the required extent. Otherwise the operation is the same as in fig. 3 ; that is to say, the lighting reverts to H.R.M. after 5-25 per cent. has been exceeded.

To provide equal and opposite magnetising ampere-turns with equal current flowing in each circuit would court financial ruin if the heating system were maintained over the lighting peak ; it is probable, therefore, that the opposing forces would generally be designed so as not to have a greater ratio than 1 : 2, or even as low as 1 : 4, until heating apparatus reaches a very much higher point of efficiency and commands a ready sale to every consumer.

Provided always that the heating peak, assuming that there is one only, does not coincide with the lighting peak in magnitude and length of time, the arrangement of fig. 4 should undoubtedly prove acceptable. The mere granting of a low flat rate for power by many authorities to-day is an admission that the diversity factor is large enough to allow the coincidence of double peaks to be ignored. It has the immense advantage of giving to the consumer facilities for using dozens of forms of really useful appliances (together with light) from the existing lighting circuits at a low rate, and the load so provided should do much to improve the load factor, especially during the two summer quarters.

There are many cases of "necessitated" lights, the first to be switched on and the last to be switched off, which ought to be distinguished from occasional lights. As already pointed out, it seems misleading to charge a consumer an apparently high rate on these. It is highly probable that a number of consumers would burn one or more lights throughout the night as a protection against burglary, provided that the cost were small and readily checked.

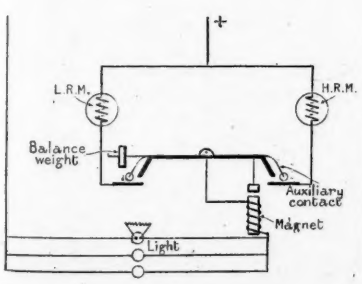



Fig. 2.

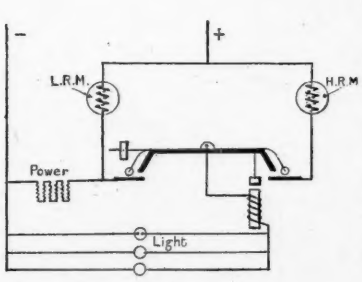



Fig. 3.

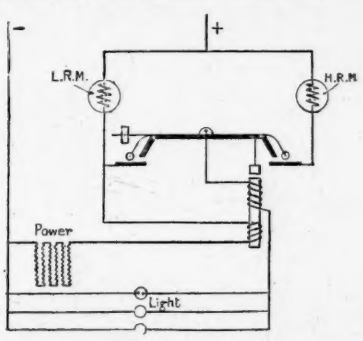



Fig. 4.

Up to the present, two-rate clock or centrally controlled systems have not made great headway, for the following reasons :—(1) The high cost of meters (clock controlled) ; (2) expert workmen are required for clock repairs ; (3) monthly winding ; (4) prolonged period of testing. And in the case of central control by a system of mains :—(5) High initial outlay ; (6) cable faults.

If heating by electricity is to be made familiar and profitable, it is a *sine quâ non* that a hiring department be inaugurated from the commencement—not only from an introductory point of view, but as an educative agency always at the service of the consumer. It is well known to engineers that a watchful eye is generally needed for undersized plug circuits when heating appliances are in use.

Before concluding, it may be useful to revert to a few points in connection with the instrument device, the working of which I have already explained.

1. The armature will rock to and fro with a change of only 0·3 ampere for a 10-ampere instrument. The magnetising loss at full load is approximately 4 watts with continuous current and 8 to 10 watts with alternating current.

2. The auxiliary contacts never have to carry more than 25 per cent. of the lighting load, except when the arrangement of connections shown in fig. 2 is employed and a large power load is carried, which is most unlikely. Both contacts are, however, designed to carry full load, so that continuity is assured; the top one only is provided with a flexible phosphor-bronze spring, which tends to give the consumer the benefit by resisting the connection with the high-rate meter.

3. Both auxiliary contacts are fitted with rollers, which relieve friction and tend to revolve with each rock-over motion. They are so pivoted that the break in the circuit as the position of equilibrium is approached is as short as possible. The inductive spark due to the magnetising current is then negligible.

4. A simple indicator, governed by the magnetising current, shows the rate in use. The balance weight can, if required, be sealed against fraudulent adjustment.

5. The complete switch in a sealed case measures 7 in. × 7 in. × 2½ in.

In an appendix methods are shown of using one meter only for a two-rate system, of 3 or 5 amperes capacity, reasonable accuracy being obtainable at low powers.

A shunt circuit is provided, with a make-and-break contact actuated by the auto-switch, and the usual stock size of meter can be used without internal alteration for two-rate use.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Cables for South-Western Railway Electrification.

The contract for the supply and erection of the cables for the electrification of the South-Western Railway Co.'s suburban lines has been placed with Messrs. Siemens Brothers & Co., Ltd., Woolwich. The leading particulars are as follows:—

Three-phase current, 11,000 volts, frequency 25 cycles per second. The cables (see fig. 1) are three-core, paper insulated,

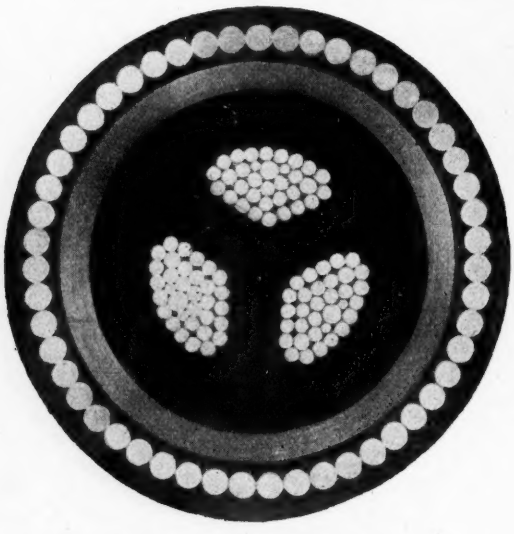


Fig. 1.—Section of Cable for S.W. Railway Electrification

lead covered, jute served and armoured with a layer of galvanised steel wires, and served all over with jute.

The approximate quantities of three-core cable to be used are as follows:—34 miles 0·2 sq. in., 21½ miles 0·15 sq. in., 19 miles 0·06 sq. in.

The chief particulars of the cables are as follows:—

| Section sq. in. | No. of wires. | Diameter of wire varying from | Thickness of dielectric between conductors and between any conductor and lead. | Thickness of lead. | Overall diameter of cable. |
|---|---|---|---|---|---|
| 0·2 | 53 | 0·06 to 0·114 | 0·36 in. | 0·16 in. | 3·17 in. |
| 0·15 | 33 | 0·054 to 0·11 | 0·36 in. | 0·15 in. | 3·01 in. |
| 0·06 | 22 | 0·048 to 0·068 | 0·35 in. | 0·13 in. | 2·65 in. |

The cables are being erected on brackets, supported on stakes driven in the ground, and were subjected to a test pressure of 25,000 volts between any core and lead.

The work is being carried out under the superintendence of Mr. Herbert Jones, M.I.E.E., chief electrical engineer to the railway company.

Fig. 2.—Consignment of Cable for Railway Electrification

Fig. 2 illustrates the first batch of finished cable before dispatch from Woolwich works.

### Electrically-Driven Watering Cart.

A correspondent who has followed our articles on the electrical vehicle question, sends us the photograph reproduced in fig. 3, of an electrically-driven watering cart in use in Turin. The

Fig. 3.—Electrical Watering Cart, Turin.

accumulators are fitted immediately under the driver's seat, and the back axle is chain driven from the motors.

Our correspondent points out that this type of vehicle would be welcomed by central stations, as it would give a useful addition to the summer load.

### Silvertown Motor-driven Reducing Gear.

Fig. 4 illustrates one of a number of special reducing gears designed by the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, to operate the damper of a bank of boilers.

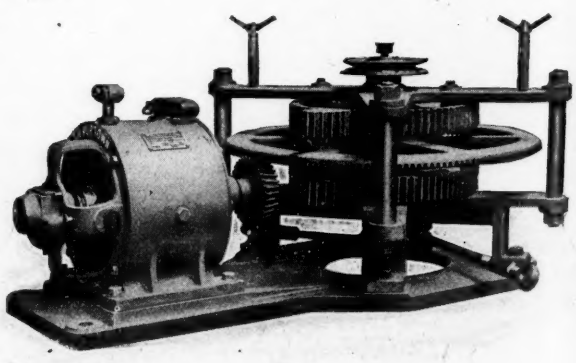


Fig. 4.—Electrically-driven Damper Gear.

The reducing gear consists of a combination of bevel and epicyclic-spur gearing, which rotates a vertical shaft. A crank is fitted to the lower end of the shaft, which operates two connecting

rods attached to the cranks on the damper. The gear ratio is 1,295 : 1; the motor is a Silvertown "Z 15" type, and develops 1½ B.H.P. at 1,295 R.P.M.

The chain wheel fitted on the top of the gear serves to drive an indicator erected in the stoke-hole, and thus the stoker can see at a glance the exact position of the damper.

As the motor and gear are installed over the boiler flue, a metal cover is fitted over the complete gear to exclude dust as far as possible; the arrangement of the gear renders it impossible for the dampers to jam when closed, should the motor be allowed to over-run.

# LEGAL.

### British Vacuum Cleaner Co., Ltd., *v* James Robertshaw and Sons, Ltd.

This case last week came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Swinfen Eady and Phillimore. upon the appeal of the defendants from a judgment of Mr. Justice Sargant, in the Chancery Division, in favour of the plaintiffs' patent.

The plaintiffs, the British Vacuum Cleaner Co., Ltd., brought the action against the defendants, James Robertshaw & Sons, Ltd., for an injunction to restrain the alleged infringement of Letters Patent (No. 17,433, of 1901), granted to Hubert Cecil Booth for "Improvements relating to the extraction of dust from carpets and other materials," of which Letters Patent the plaintiff company were the owners. The plaintiffs also claimed damages. In the specification it was stated that it was essential for practical success to drive by power the pump employed for producing a vacuum, and to maintain a vacuum of at least 5 lb. per sq. in. in the filter on the side of the filtering medium where the air and dust entered when the apparatus was at work, and that it was only to extractors working with a considerable vacuum that the claims related. The first claim was for the combination of an extracting implement connected with a power-driven suction pump and dust collecting means interposed between the said implement and pump substantially as, and for the purpose, specified. In a previous action the House of Lords held that there was subject-matter in the patent in question, and that it was valid. In the present action the plaintiffs complained of threats to infringe, and of actual infringement, by the defendants. The alleged infringing machine had suction bellows instead of a cylinder pump.

The defence was that the plaintiffs' patent was invalid upon the ground that the alleged invention therein contained had been anticipated by specifications published by James Joseph Harvey, of Kidderminster, in 1893 and 1894, and the prior user of machines made under Harvey's patent. Defendants further denied infringement, on the ground that the patent sued on did not cover suction bellows, although worked by motor, and on the ground that the machine complained of did not work with a 5-lb. vacuum.

Mr. Justice Sargant held that the statement as to a vacuum of 5 lb. was directory only; that the plaintiffs' patent had not been anticipated; that the defendants had threatened to infringe, and had infringed, the plaintiffs' Letters Patent. His Lordship accordingly granted the plaintiffs an injunction, an inquiry as to damages and the delivery up and destruction of infringing articles, and ordered the defendants to pay the costs of the action. The inquiry as to damages was stayed pending the present appeal.

Mr. Walter, K.C., and Mr. J. Hunter Gray (instructed by Messrs. Farrar & Co.) appeared for the appellants; and Mr. T. Terrell, K.C., and Mr. Colefax, K.C. (instructed by Messrs. Hasties), for the respondents.

Mr. Walter, upon the issue of infringement, contended that what the defendants did was not within the plaintiffs' patent, Booth's specification being limited to 5 lb. vacuum substantially, and he contended that a machine such as the defendants, giving 2½ to 3 lb. vacuum, did not infringe. If the patentee's specification was construed, as he contended it should be, his clients did not attack the validity of the patent, but if it was not so construed he submitted that the machines which had been used would cover the plaintiffs' patent, and so anticipate it.

The hearing was continued on Monday, and at the conclusion of counsel's argument, the Court reserved judgment.

### Benkert *v.* Harman Allen Manufacturing Co.

In the Shoreditch County Court, on November 11th, before his Honour Judge Cluer, Elizabeth Benkert, a widow, of 48, Wilson Street, E.C., sued the Harman Allen Manufacturing Co., of 7, Fort Street, Spitalfields, for £6. It appeared from the evidence that the defendants estimated for two new field coils, impregnated, to be fitted to a 1½-H.P. electric motor, and assemble, test and deliver same, at a cost of £3 19s. 6d. After it had been in use for a little while, it was suddenly found that the insulation had burned out, a most incomprehensible thing, as it should have lasted for years. Some correspondence ensued, but both took up a dignified attitude, one side saying they would not go to inspect it, as there was no doubt the damage had been done by dampness, whilst the other side would not take it for inspection.

Judge Cluer positively declined to look at the correspondence, as he said no good could be done by reading what was written by so-called business people who would act like it. It was like a couple of ladies disputing on the etiquette of which had to call on the other first, or a pair who are quarrelling as to who shall raise his hat first.

The Plaintiff said the work had been put right by Messrs. Anderson & Anderson, and had cost £6, for which they were asking payment.

David Anderson, engineer-in-charge to the East Ham Corporation, said he examined the work, and found that one coil had burned out through defective insulation. One layer of tape was not sufficient for 500 volts.

The Defendant said the work was not guaranteed, so that they could not be held liable. It was not a question of bad work, but of dampness.

Judge Cluer said there might not be a specific guarantee as to the work, but everybody knew that in that class of work it was understood that it would last a reasonable time if the work was properly carried out. In this case it was not properly carried out, apparently, as it went wrong almost immediately. He gave a verdict for the plaintiff for £5 15s. 6d., and costs.

### Electric Shock Claim.

Before the Sheriff-Principal of Fife, a boy who had received a shock by putting his hand on the snib of a window in the Lochgelly Opera House connected with a live electric wire, claimed damages for injuries thus sustained. On behalf of the defender, the lessee, it was pleaded that he was entitled to take unusual means of protecting his property against interference, and that, in any event, the boy had no right to interfere with the snib.

The Sheriff dismissed the action as irrelevant.

# BUSINESS NOTES.

**Consular Notes.—China.**—The British Consul at Foochow reports that the works of the Foochow Electric Light Co. were completed in March. The light is laid on to the city, and several outlying districts, including the foreign quarter in Nant'ai. The main streets of the suburbs are also lit, and electric lamps have replaced the Kitson lamps hitherto used on the large bridges connecting Nant'ai with the mainland. The plant, purchased through a Japanese company and erected under the supervision of a Japanese engineer, is of best British manufacture. The current is good, but on the south side of the bridges is only laid on at night. The manager and staff of the company are Chinese.

The Consul at Nanking states that the Nanking Electric Light Co., a Chinese concern, is reported to have now established itself on a satisfactory footing and to be making a small profit. The practical working is not always all that could be desired. The Telephone Co., also Chinese, is a very inferior installation.

**Peru.**—The British Consul at Cerro de Pasco states that the Cerro de Pasco Mining Co. and the Morococha Co. have taken possession of the rivers and waters between Oroya and Morococha for the purpose of erecting a powerful factory to serve both the companies for lighting and power. They have started to erect the plant, which is expected to be ready in about a year's time.

**Brazil.**—The Consul at Rio Grande reports that the tramway system of that city has been bought by the concessionaires of the port works, and has been electrified. All the material employed has been imported from the United States. The city of Pelotas, an exception to most of the towns in the State, has not up to the present had the electric light, but an electric power station will shortly be established for electrifying the tramways and for other purposes; the contract was secured by a firm from Buenos Ayres. A great many of the small interior towns are lighted by electricity. There has not, so far as the Consul knows, been any interest shown in these enterprises by British firms.

**Sweden.**—The American Consul at Goteborg, in a recent report, refers to a meeting of the board of managers of the Goteborg electric light and power plant, a municipal enterprise, at which the director brought forward a novel plan to introduce electricity into the one and two-room flats. Of the 30,000 apartments of two rooms and kitchen or less in Goteborg, only 3,100 are supplied with electricity. The chief reason for this is the expense of installing a special meter post for each two-lamp apartment. The house-owners have not felt inclined to go to such expense, and the tenants have not been willing to spend so much on apartments that they might occupy for only a short time. The director of the electric plant proposes to join all the small apartments in a house with a common current limiter, the rental for the number of lamps for which the limiter is adjusted to be paid by the house-owner to the electric company, and the house-owner to be reimbursed by additional rental for each apartment. This system has been tried in four houses, averaging 21 apartments each, and the results have been satisfactory. The installation costs per house were reduced about 40 per cent. The cost of current will amount to 50 öre (6½d.) per lamp per month, or 1 crown (1s. 1½d.) per month for two lamps. At present the consumer pays 15 crowns (16s. 10½d.) per year for two lamps, plus the current limiter.

The Consul at Stavanger also reports a cheapening of current in that town for cooking and heating purposes. The rate was formerly the same as for lighting, viz., 14 öre (2d.) per KW.-hour. The new rate is 2 or 4 öre per KW.-hour, depending on the time of day when the current is used. To further encourage the use of electricity for household purposes, the engineer of the municipal electric plant has organised a class for housewives for instruction in the use of

electrically-heated cooking apparatus. Electric lighting is universally used in the Stavanger district as a result of the cheap hydro-electric power made possible by the many waterfalls. Even the peasants and fishermen dwelling on the fjord islands have electric lighting in their homes. The Consulate is well equipped with electric light, which, during the winter months, is used during the day as well as in the evening.

**Norway.**—The American Consul at Christiania reports that the use of electric appliances is limited in Norway, notwithstanding the fact that electricity is used everywhere, and that it is furnished to consumers at very low rates. Appliances having the largest sale are electric irons, fans, chafing dishes, one and two-hole broilers, and small hot or cold air blowers for drying the hair. The cost of electric current furnished to householders is 3½d. per KW.-hour. For technical purposes the rate is 2½d. per KW.-hour. On yearly contracts the rates are lower—2½d. per KW.-hour for domestic use, and for technical purposes £5 per H.P. up to 15, and about £4 per H.P. if more than 15 H.P. is used. In other Norwegian cities the rates are also low. Electricity is used for heating purposes and for general cooking to a very limited extent. A few householders whose space is limited or where the use of coke stoves is impracticable, employ electric heaters and ranges, and a few amusement places, in operation for only two or three hours a day, find electric heating convenient. With coke at 16s. 8d. or 18s. 8d. a ton, and wood 10s. 6d. or 12s. 6d. a load, heating and cooking by electricity are considered too expensive at the present price of electric current, though a contemplated reduction in rates may bring about decided changes. The original cost of electric appliances is also too great to permit of their universal use. A few appliances are now being manufactured in Norway, but the majority are imported from Germany, with smaller quantities from the United States, Sweden and England.

**Lapland.**—The American Commercial agent reports that the richest and probably the largest iron-ore mine in the world is located at Kiruna, Lapland, in latitude 68½° north, which is about the same as the northernmost boundary of Alaska. The climate is somewhat milder than in Alaska, and these mines are worked the year around. About 1,600 men are employed and the equipment is the most modern machinery obtainable. Machine tools for the repair shop, air compressors, and rock drills, and several of the largest steam and electric shovels, are of American make. Orders have been placed with an Ohio company for a large addition to their electrical shovel equipment, the machines of this concern having proved superior to other makes which have been used in the mines.

The plant is at present operated by steam power, the coal supply coming from England and Spitzbergen. Steam coal is delivered here for about 18s. 8d. per ton. The electrification of the mines is in progress, and this power will be used exclusively as soon as the new power plant of the State of Sweden, now under construction at Porjus Falls, is completed. The transmission line is completed, and it is expected that the power station will be ready to deliver current early in 1914. 150,000 H.P. will be the capacity of this station, and transmission will be at 78,000 volts over a distance of 150 miles. The State railway between Kiruna and Narvik is being electrified and will be operated from this station. The ore is shipped from Kiruna to Narvik on the Norwegian coast by rail, and from there by water to Germany, a small percentage finding its way to other countries. The equipment is being rapidly increased and will soon be sufficient to ship more than 10,000,000 tons per annum.

Up to the present time about 25,000,000 tons of ore have been shipped. The ore is magnetite and contains from 53 to 68½ per cent. iron.

**Electrical Trade in Greece.**—According to an Austrian Consular report on Greece, electrotechnical articles are daily finding an increased sale, as large installations are being carried out or are projected. Numerous firms have been established during the past 10 years for the sale of the smaller installation material, whose requirements are mostly supplied from Germany. An extensive trade is done by these firms, whose financial standing is of a satisfactory character. The chief customers for electrical installation and kindred articles are the Electrical Co., the Gas Co., and the General Post and Telegraph Administration. To be able to promote business relations with these latter, well-introduced local agents must be employed, otherwise sales will be hard of attainment. In the coming three years large installations in the department of telegraphs and telephones are projected, with which is bound up a considerable call for appropriate material. The Gas Co. and the Electric Co. place most of their orders for material with their parent houses in Paris. Nevertheless, orders are placed elsewhere for particular articles. On such occasions they turn to the leading European makers with the invitation to submit offers, and choose finally the most competent who quote the lowest prices. Goods thus indented for comprise dynamos, motors, electrical fittings, high-pressure cable and transmission lines, a variety of installation accessories, electric lamps and instruments, and electrolytic copper. France is among the suppliers of dynamos, motors, transformers, electrical instruments and electrolytic copper. Switzerland is also a contributor, but more particularly of high-pressure wire and electrolytic copper. Transmission lines are supplied from Belgium, electrical instruments from England, and low-pressure wire from Sweden. High-pressure wire is at times procured from Hungary, and electrical apparatus and instruments from Austria. Electric motors and dynamos are in comparatively small request, as the Electric Co. in the capital generally sells current at too high a price. A tendency, however, is observable, and especially in the cases of newly-starting firms, to employ electric motors. Many motors and dynamos are also supplied by the Electric Co. itself, or else procured through agents abroad.

**South African Customs Invoice Regulations.**—The South African Section of the London Chamber of Commerce (Incorporated), and the South African Merchants' Committee have recently made representations to the High Commissioner for the Union of South Africa relative to the Regulations under the Customs Management Act of the Union of South Africa, under which it is laid down that invoices shall contain :

1. A statement in a prominent place as to the current value for home consumption in the open market for similar goods at the place of purchase, bought in the ordinary manner and manufactured or supplied in analogous quantities; and
2. That the invoice shall also clearly show the cost of packing and packages.

As a result of the correspondence with the High Commissioner referred to, it is recommended (except as regards definite contracts, to which reference is made later), that suppliers should give effect to these Regulations in the following manner :—

(*a*) In cases where the price charged on the invoice and discounts allowed and the home consumption value are alike, sign a declaration to the following effect :—

"I declare that the values appearing on the body of this invoice represent at the date of the invoice the open market value of the goods if sold for home consumption in Great Britain, and that the discounts shown are the same as those granted on similar quantities sold for consumption in Great Britain."

(*b*) In the instances where the price charged on the invoice and discounts allowed and the home consumption value are divergent, enumerate the latter on the invoice in a parallel money column and declare that "the discounts for similar quantities for home consumption are . . . . ."

Where the price charged the consumer is a contract price, the invoice must clearly indicate the current value for home consumption at the date of the contract, thus :—

| — | Current value for home consumption. | Selling price to purchaser in South Africa. |
|---|---|---|
| | | |

and the words "at the date of contract" substituted for "date of the invoice." In all cases the cost of packing and packages must be given. The declarations must be signed, and the figures given authenticated, by either manager, principal, director or secretary of the firm or company making the same. From communications with the Commissioner of Customs of the Union of South Africa, it is understood that if the above recommendations are carried out by the suppliers, they will meet the requirements of Clause 103 of the Regulations published under the Sections of the Act referred to. The Commissioner of Customs intimates that should any general laxness become apparent in the signing of such certificates, the value and discount for home consumption will be insisted on in the body of the invoice for the several items thereon.

**Catalogues and Lists.**—The Cable Accessories Co., Ltd., Britannia Street Works, Tividale.—New catalogue of 100 pages (No. 7), containing illustrations, brief particulars, with prices and code-words, of a variety of "Sceaco" water-tight electric light fittings, single light vertical and mill fittings, cluster light fittings, street lighting lanterns, shop window fittings, globeless fittings for street lighting, hand lamps, ships' fittings, cargo cluster fittings, bulkhead or sconce fittings, arc lamp winches, and various accessories.

Messrs. Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.—New edition of sectional catalogue No. 1,132. Its 48 pages are occupied with fully-illustrated matter relating to "Sturtevant" forge plants and forges. The opening pages show pictures of a number of engineering and other works where their smoke and fume-exhausting system is employed. Particulars of stationary and portable forges, motor-driven forge fans, &c., follow.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Publication No. 745 gives descriptive notes and tabulated prices and code-words of the "Monarc" and "Aston" enclosed arc lamps, and "Aston" automatic weight-relieving contact gear.

The Mica Lubricant Co., 63, King Street, South Shields.—Illustrated circular relating to "Micaline" lubricant for electric cars, mica grease and packings, automatic lubricators, &c.

The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, London, N.—Sixteen-page pamphlet giving prices and particulars of centrifugal and plunger pumps in combination with Westinghouse cross vertical enclosed oil engines.

Messrs. Landau & Co., St. Ann's Chambers, Orchard Street, Westminster, S.W.—Several illustrated lists describing and giving prices of the "Lanco" electric heating cushions for bed or poultice use ; the "Lanco" electric rug and foot-mats ; and the "Lanco" electric heater for heating and boiling liquids by immersion.

The Railway Truck Supply Co., 81, Gracechurch Street, London, E.C.—Twenty-four-page illustrated catalogue of electric trucks for baggage and freight service, as supplied by the Elwell-Parker Electric Co., for whom the firm are representatives for Great Britain and the Colonies.

Siemens Brothers Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—Price List No. C.L. 2 (Second Supplement) dealing with electrical illumination devices for Christmas and festive decorations, which they supply in great variety ready wired for connecting to circuits from 100 to 250 volts. Illumination lamps of many varied shapes are available for use on Christmas-tree decoration, including representations of fruit, flowers and

birds. All these types can be obtained with clip contacts simplifying wiring. Members of the trade can have copies of the list on application.

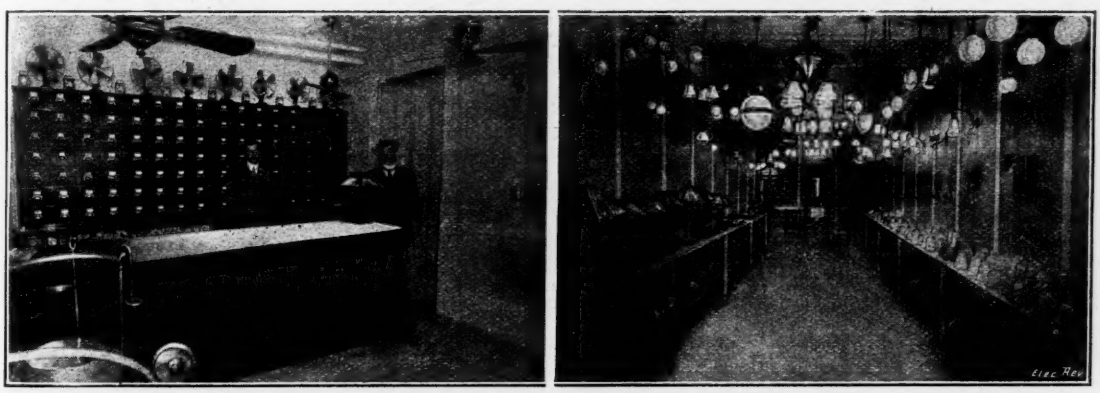
The Gledhill-Brook Time Recorders, Ltd., 43, Market Street, Huddersfield.—24-page pamphlet, containing illustrated particulars of their "Empire" time recorders, "Empire-Clipper" recorders and job-costing equipments, and specimen cards showing their use.

Messrs. A. West & Partners, 91-98, York Street, Westminster, London, S.W.—A very useful catalogue of 200 pages, containing a vast quantity of information, with prices and a profusion of illustrations, regarding a great variety of surveying instruments, drawing office instruments, stationery and equipments, architects' and engineers' photographic, photo and plan printing materials and apparatus, filing cabinets and other office furniture.

The Peel-Conner Telephone Works, Ltd., Salford.—48-page bulletin (No. 3), containing excellent large half-tone pictures, line diagrams and descriptive matter relating to some of the exchange equipments that they have installed for telephone administrations at home and abroad. We are sure that the publication will be of interest to all telephone engineers, and they can secure copies on application.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—The firm are issuing to electric light consumers, preference being given to users of Siemens lamps, copies of a picture in colour, which attractively and quite unobtrusively advertises "Wotan" lamps. The prints are issued ready for framing. There are other features in the picture beside the lamp, which in some cases may divide the admirer's attentions.

**A Canadian Electrical Store.**—In the accompanying pictures we show a couple of views in the premises of the Sun Electrical Co., Ltd., at Regina, Saskatchewan, who are claimed to have the best equipped electrical showrooms in Western Canada. This is one of the firms for whom Messrs. Chiswell & Co., of



Views in a Canadian Electrical Store.

Kingsway, W.C., are acting in the capacity of European purchasing agents. The Canadian Sun Co. is not connected with an English company of a similar name. The lines of manufactures that it handles—fittings, cooking apparatus, telephones, power equipment, &c.—are mostly of British manufacture, and some of the articles appearing in these illustrations have been specially made to meet Canadian requirements.

**Lead.**—Messrs. James Forster & Co. report as follows under date November 15th: "The débâcle in the copper market this week, together with the pessimism which is so marked a condition of all markets outside metals, has had its natural effect on the lead market notwithstanding the intrinsic position of the metal, and we have had a recession in values for all positions of considerable importance. So very little lead has come in; the large arrivals expected end of last week and this have not made their appearance, and the difficulty and inconvenience the delay has caused are very serious. The lead is urgently wanted. In normal times the bare condition of consumers' stocks and the absence of any lead in the shipping ports would have maintained prices, but these are not normal times, and despite the scarcity we have a falling market and very little selling is sufficient to act adversely on values. Closing prices last week were: October £20 12s. 6d., November £19 17s. 6d., December £19 10s., and January £19 5s. Last night's market developed into a regular slump and closed at lowest, November at £18 12s. 6d., December £18 7s. 6d., March £18, with buyers for prompt at £19, and February £18 2s. 6d."

**Whist Drive.**—Messrs. A. Reyrolle & Co.'s employés held their annual whist drive and dance in the Hebburn Co-operative Hall on Friday last. The event was the most successful yet held. After whist and supper, prizes for the works' annual sports were presented by Mrs. Reyrolle, who was presented with a handsome bouquet. Mr. H. C. Stuart, of the purchasing department, then moved a vote of thanks to Mr. Reyrolle, and referred to the very cordial relations existing between the officials and workmen. Mr. P. Wright, of the switch department, seconded, and Mr. Reyrolle suitably replied. A programme of dancing, &c. followed.

**Bankruptcy Proceedings.**—W. R. Wedge, electrical engineer, The Arcade, Northampton.—The adjourned public examination of this debtor was fixed to be held at the County Hall, Northampton, on November 11th, when the statement of affairs showed liabilities amounting to £165 and assets estimated to realise £75, leaving a deficiency of £90. Mr. W. G. S. Fawkes (Messrs. Scriven, Terry & Fawkes) attended on behalf of interested parties, but the debtor was not present. The Official Receiver stated that the debtor had gone to a situation at Bury, Lancashire. In view of what transpired at the previous hearing, he had written to debtor, pointing out that it would be necessary to furnish an amended statement of affairs before he could pass his public examination. The book debts, which were first put at £128, and later at £84, estimated to produce £75, as a fact had only produced £25 7s. 10d. The Official Receiver had pointed out to the debtor that he had not complied with the conditions of the Bankruptcy Acts, and that it rested with him whether he passed his public examination. The debtor had replied that he had no money for his railway fare to Northampton. The Official Receiver submitted that if the matter was not properly cleared up the case must be adjourned *sine die;* but, in order to give the debtor an opportunity to comply with the requirements, he would apply for an adjournment. The Registrar accordingly ordered the case to stand adjourned.

Woolf Barnett, electrician, 269, Mile End Road, E.—The public examination was held on November 12th, before Mr. Registrar Hope, at the London Bankruptcy Court. The accounts showed liabilities £59 16s. 4d. and assets nil. In the course of his evidence, the debtor stated that he came to this country from Poland 33 years ago, and had not been naturalised. His failure was due to liability incurred on behalf of his son, who was also in the court. The examination was concluded.

Prested, —— (male), St. John's Park, Holloway, N., electrical engineer.—Receiving order made November 12th, on creditors' petition. First meeting November 26th; public examination December 19th; both at Bankruptcy Buildings, Carey Street London, W.C.

John Samuel Richards, Marfleet, Kingston-upon-Hull, electrician.—Receiving order made November 10th, on debtor's own petition. First meeting November 25th, at Official Receiver's office, York City Bank Chambers, Lowgate, Hull. Public examination December 8th, at Guildhall, Hull.

**Callender's Cable Works Prize Band.**—On Saturday last the above band, connected with Callender's Cable and Construction Co., Ltd., gave a concert in the works' dining hall. Among the officials of the firm present were Mr. J. O. Callender, Mr. A. R. Kibblewhite, Mr. S. Goodman, &c. During the evening the 50-guinea shield (first prize of the Preliminary Shield Section) won at the Crystal Palace contest on September 27th this year, was presented, Mr. Iles, the founder and director of the great annual band festival, handing the shield to Mr. T. O. Callender, the managing director, who presided. The band has competed seven times in this festival, winning three first, two second, and one third prizes. It has had a successful contest season, having entered six competitions and winning prizes on each occasion—three firsts and three seconds. Its record to date is:—20 contests entered; prizes won, 16. Congratulations!

**Shipping Exhibition.**—In connection with the Shipping, Engineering and Machinery Exhibition, which is to be held at Olympia, from September 25th to October 17th, 1914, we are informed that a Royal Commission has been appointed by the Netherlands Government for the purpose of organising a collective exhibit of Dutch shipping (naval and mercantile), shipbuilding and engineering on this occasion. Among the members are many of the most important business men in Holland, including the burgomasters of Rotterham and Amsterdam.

**Canadian Business Tours.**—According to the *Times*, arrangements are on foot for a visit of Canadian business men to Great Britain in March or April next and for a return visit of British business men to Canada in August. Mr. C. F. Roland, Commissioner of the Winnipeg Industrial Bureau, is in London in connection with the matter.

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**Book Notices.** — *Recherches Expérimentales sur le Coupage des Fers et Aciers par les Chalumeaux à Jet d'Oxygène.* By R. Amédée. Paris: Union de la Soudure Autogène. Price 3 fr.—In this brochure is given a full account of the method of cutting steel with the oxyhydrogen and oxyacetylene blow pipes, in minute detail. Numerous micro-photographs are reproduced to illustrate the physical processes involved, and the influence of impurities in the oxygen, and of variations in the pressure of the gas, is discussed. The effect of the operation upon the metal in the neighbourhood of the cut is described, and the consumption of the gases employed under given conditions is given. The work should be of great value to those who contemplate the use of this powerful modern agent.

*The "Mechanical World" Pocket Diary and Year Book*, 1914. Manchester: Emmott & Co., Ltd. Price 6d. net.—New matter on steam turbines, milling and gear-cutting, keys, pipe threads, pipe joints, weights of nuts, &c., has been included, and the work as a whole revised. It is wonderful value for the money.

*La Soudure Autogène.* By l'Institut Scientifique et Industriel. Paris: *Mois Scientifique et Industriel.* Price 2.75 fr.—This book describes and explains the various processes of autogenous welding in use, with their advantages and drawbacks, and gives practical directions for their operation, together with details of cost. Hydrogen for this purpose is best prepared by electrolysis, and some particulars are given of commercial apparatus for this purpose; the cost is from 1 to 1½ fr. per m³. One chapter is devoted to electric welding, including spot and seam welding. The work is very complete and detailed, and deserves hearty commendation.

*Second Report of the Committee on Reinforced Concrete.* London: William Clowes & Sons, Ltd. Price 2s. 6d. net.—The Committee of the Institution of Civil Engineers, which presented this report in July last, is presided over by Sir William Matthews, with Dr. Tudsbery as secretary. Since the first report, issued in June, 1910, research has been carried on in various directions, and a quantity of very valuable information has been brought together in the volume under notice, which includes reports on tests of plain and reinforced concrete slabs, percolation tests at the N.P.L., tests on columns and beams, calculations, formulæ, &c., with descriptive reports of work actually carried out.

"Application of Electric Power to Mines." By W. H. Patchell. London: Constable & Co., Ltd. Price 10s. 6d. net.

"*Bulletin* of the Association des Ingenieurs Electriciens." Vol. XIII, No. 9, September, 1913. Liége: The Association. Price 4 fr. 50 c.

"*Journal* of the American Society of Mechanical Engineers." November, 1913. New York: The Society. Price 35 cents.

"*Proceedings* of the South Wales Institute of Engineers." Vol. XXIX, No. 5. November 10th, 1913. Cardiff: The Institute. Price 5s.

"*Proceedings* of the Engineers' Club of Philadelphia." Vol. XXX, No. 4. October, 1913. Philadelphia: The Club. Price $2.

"The Practical Metallography of Iron and Steel." By J. S. G. Primrose. Manchester: Scientific Publishing Co. Price 3s. net.

"Text-Book of Applied Mechanics." Vol. V. Eighth Edition. By Andrew Jamieson. 1913. London: Charles Griffin & Co. Price 7s. 6d.

"Electro-Thermal Methods of Iron and Steel Production." By J. B. C. Kershaw. 1913. London: Constable & Co. Price 8s. 6d. net.

"The Hidden Danger and How to Avert It." Doncaster: *The Doncaster Chronicle.* Price 3d.

"*Transactions* of the University of Toronto Engineering Society." Vol. VIII, No. 6. October, 1913. Toronto: The Society.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXII, No. 11. November, 1913. New York: The Institute. Price $1.

"*Transactions* of the Illuminating Engineering Society." Vol. VIII, No. 7. October, 1913. New York: The Society. Price 75 cents.

"The Physical Review." Vol. II, No. 4. October, 1913. Lancaster, Pa.: The American Physical Society.

"Les Surtensions dans les Distributions d'Energie Electrique et les Moyens d'en Prévenir les Inconvéniente." By S. van Dam. 1913. Amsterdam: Van Mantgem & de Does. Price 10s.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXX. October, 1913. Brussels: E. Bruylant. Price 1 fr. 75 c.

"Atti della Associazione Elettrotecnica Italiana." Vol. XXII. Nos. 19 and 20. October 15th and 31st, 1913. Milan: Stucchi, Ceretti & Co. Price L. 1.50 each.

"Aufstellung liegender Wasserturbinen für Gefälle von 3 bis 30 m." In German, English and French. By Johann Hallinger. Munich: J. C. Huber.

Messrs. Crosby Lockwood & Son, of 7, Stationers' Hall Court, London, E.C., have just issued a new illustrated catalogue of 108 pages of their scientific, technical and industrial works. Copies will be sent to any reader interested, on application.

**British Engineers' Association.**—We commend to the sympathetic consideration of all of our manufacturing readers who are not already connected with the above Association a 32-page booklet that has just been issued dealing with its possibilities and its achievements, and setting forth reasons why eligible firms should join. As our readers know, the Association is, in the first instance, centring its attention upon the Chinese market, and the pamphlet, therefore, contains a good deal of information bearing upon this subject. The Association and the merchants, the Hong Kong University, German and American influence on Chinese education, are among the topics briefly touched upon. Firms likely to be interested should ask the secretary for a copy of this booklet; the offices of the Association are at 32, Victoria Street, S.W.

**Liquidations.**—The Universal Cable Code (Parent) Co., Ltd.—A petition for the winding up of this company has been presented by Herman Schneider, merchant, and will be heard on December 2nd.

Ohio Power Syndicate, Ltd.—A meeting will be held at 66, Bishopsgate, London, E.C., on December 22nd, to hear an account of the winding up from the liquidator, Mr. E. J. Trollope.

The Preston Electric Co., Ltd.—A meeting of creditors will be held at 12, Bennett's Hill, Birmingham, on November 24th, at 12 o'clock noon.

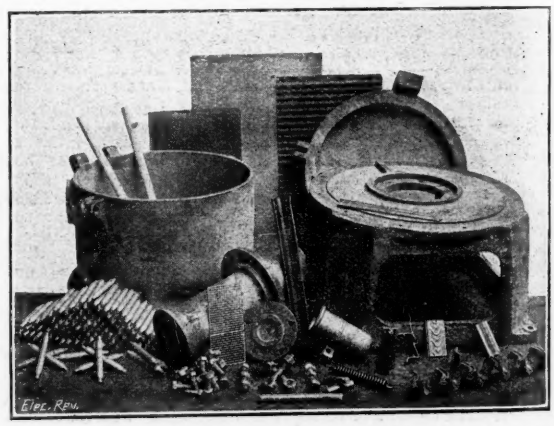
J. Defries & Sons, Ltd.—A meeting will be held at 4B, Frederick's Place, Old Jewry, on December 15th, to hear an account of the winding up from the liquidator, Mr. A. F. Whinney.

**Trade Announcements.**—Mr C. E. Wilson, of Johannesburg, and Mr. F. Peabody Rice, of the same city, have entered into partnership, and will carry on business under the firm name of Peabody Rice & Wilson, with offices at 22, Standard Bank Buildings, Harrison Street, Johannesburg. Mr. Wilson has been in charge of the South African interests of the British Insulated and Helsby Cables, Ltd, for many years.

Mr. E. Wallis, electrical contractor, has taken over the business of the late Mr. R. Cloake, of 26, High Street, Sevenoaks, and will carry it on under the style of Cloake & Wallis.

**Deed of Assignment.**—H. J. Bentley (Bentley and Co.), electrical engineer and ironmonger, Manchester.—Creditors must send in their claims, &c., by November 29th to the Trustee, Mr. J. W. A. Hirst, 28, Queen Street, Albert Square, Manchester.

**Lead Coating of Metals.**—The efficient protecting of iron and steel from corrosion and the preserving of tubes, castings and other metallic articles from acid fumes and corrosive liquors, has always been of great interest to engineers and others. In the accompanying figure is shown a group of articles which have been




Lead-coated Metal Articles.

successfully coated with lead to a thickness of about $\frac{1}{16}$ in. The figure shows castings for centrifugal machinery, roof glazing bars and plates, springs, bolts and nuts, &c. These articles have been leadised by the electrolytic deposition of lead by Messrs. Lead, Ltd., of 1 and 2, Old Pye Street, Westminster, S.W.

**Sweden.**—A new electro-metallurgical company has recently been formed at Arboga, in Sweden, for the purpose of building a new works for the manufacture of corundum, silicon carbide and ferro-alloys. The company has a capital of £11,100 in fully-paid shares, and the well-known Swedish metallurgist, Engineer Grönvall, is one of the promoters.

It is reported from Stockholm that the Almänna Svenska Elektriska A/B has formed a subsidiary company at Copenhagen, with the view of getting into a better position for supplying the Danish market.

**Correction of Advertisement.**—We are asked to announce, in connection with the B.T.H. Co.'s Veluria reflector advertisement in our issue of November 7th, that the prices of the 60 80-watt and 200-watt extensive type reflectors were incorrectly stated. The price of the 60-80-watt reflector is 3s. 6d., not 3s., as printed; and that of the 200-watt reflector is 19s., not 19s. 6d., as printed.

**Lifting Magnets in Steel Works.**—Having accumulated an enormous amount of scrap metal, in the course of 20 or 30 years, one of the largest steel works in this country decided to resort to lifting magnets for its removal, and obtained one from the Witton-Kramer Electric Tool and Hoist Co. (for whom the General Electric Co., of Queen Victoria Street, London, E.C., are the sole selling agents); the magnet is 42 in. in diameter, and is suspended from a travelling jib crane. By this means the difficulties of handling turnings and other scrap are obviated.

## LIGHTING and POWER NOTES.

**Acton.**—In a letter to the U.D.C., laid before its Works Committee last week, the Metropolitan Electric Supply Co. stated that the failure of the supply of electricity to the pumps at the sewage disposal works on the 20th ult., was due to an accident at the Willesden works. The surveyor stated that if there were a serious breakdown whilst a storm was in progress the matter would be grave. Several breakdowns in the local supply had taken place during the last three years, but since the company had installed its new plant in Acton Lane no complaint had been made.

**Argentina.** — The Bolivar T.C. has approved the specification for the electric lighting of that town and tenders will shortly be called for.

The concessionaire of the electric light stations in Ramos Mejia and San Justo expects to have the installations completed by the middle of December.—*Review of the River Plate.*

**Australia.**—The Melbourne Harbour Trust Commissioners have prepared a scheme for substituting electricity for gas lighting in all cargo sheds, wharfs and roads at Victoria Dock, the north side of the river from the dock head to Queen's Bridge, and on the south side from Queen's Bridge to the dock. The estimated cost is £5,079, and it is anticipated that two of the three sections will be in operation by the end of the year.

The Brunswick Council has decided to borrow £7,000 for extensions to the electric supply scheme.

**Bannockburn.**—A system of electric lighting is to be installed, the power being obtained from Bonnybridge.

**Barnes.**—PROPOSED LOAN.—The U.D.C. is seeking sanction to borrow £7,500 for the purchase of mains and services.

**Barton.**—At a meeting of the R.D.C. on the 12th inst. it was decided to oppose the Manchester Corporation Bill which seeks powers in regard to Trafford Park. The clerk was authorised to obtain the necessary legal assistance.

**Bentham.** — E.L. SCHEME. — The formation of the Bentham Electric Light Co., in an interesting instance of a kind of village development which, in the West Riding of Yorks., seems likely to increase. Bentham is an old-time village of the larger sort on the north-western edge of the county, within a very short distance of Lancaster ; there is a gas supply, but many of its people are still living in the oil lamp era. The new electric supply company has been formed by some local residents, and current is to be supplied at 5d. per unit, at which figure it will compete successfully with the local gas supply.

**Bradford.** — L.G.B. INQUIRY. — An inquiry was held by Mr. T. C. Ekin, on Thursday last week, in connection with the application of the Corporation for power to borrow £91,250 for extensions at the electricity works. Evidence was given by the deputy town clerk and the engineer, Mr. T. Roles, that owing to the increased demand for electricity for power purposes—particularly for the driving of textile works—the Committee had decided to apply for a loan for extending the plant. At present all the power that the turbines were capable of generating was being used, and if the extensions were not proceeded with very shortly they would be threatened with a breakdown. Had it not been that trade was slack, it was pointed out, the electricity department would be in an even worse position than it actually was. There was no opposition to the application.

**Canada.**—Mr. W. C. Hawkins, managing director of the Dominion Power and Transmission Co., has announced officially that the company will build an auxiliary plant at the foot of James Street, Hamilton, on the bay front, to develop 90,000 H.P., and that the plant and equipment will cost $3,500,000. The work is to be commenced next year, so as to have the plant in operation by next autumn. This plant will remove all possibilities of interruption by needle ice, and will always be in condition to supply power at short notice.—*Canadian Engineer.*

**Chesterfield.**—The T.C. is applying for powers to extend its area for the supply of electricity to the parishes of Brampton, Walton and Tapton.

**Chiswick.**—PROPOSED E.L. PURCHASE.—The acquisition by the U.D.C. of the undertaking of the Chiswick Electricity Supply Corporation, Ltd., is to be considered at the next meeting of the Council, and a proposal made that application should go forward in the next session of Parliament for an Act to obtain powers for this and other purposes.

**Continental Notes.**—SWEDEN.—The Höganäs-Billesholm A/B, the only Swedish coal mining company, has recently opened up a new shaft at Ormestorp, and thereby increased the output very considerably. As part of the production consists of coal of an inferior quality, the company has decided to employ the quantity which is not used at its own works, for the production of electrical energy on the spot. The plant will be constructed with a capacity of 7,000 KW., of which 2,000 KW. will be employed for the company's own purposes. Other 2,000 KW. has already been disposed of to the South Swedish Power Co., which needs the supply as a reserve for its own stations, which are now worked to their full capacity. The remainder will be disposed of to various industrial concerns in the surrounding districts, as well as to municipalities and private people. As such a large quantity as 2,000 KW. is to be kept in reserve for the above-mentioned power company, the new power station will only occasionally be worked to its full capacity. The plan of usefully employing inferior coal in this way instead of selling it at a nominal profit, or, perhaps in some cases, without any at all, in order to get rid of it, speaks for itself, and it is expected that the company will derive great benefits from it.

The Trollhättan Electrical Works, which belong to the State, and which have their source of energy in the Trollhättan waterfalls, are now going to be completed by the addition of four new sets to the present power plant, which comprises eight sets of 10,000 E.H.P. each. When completed, the whole plant will comprise 12 sets of 10,000 H.P. each, and will thus be capable of supplying 110,000 H.P., with one set in reserve.

The authorities have now decided to ask the Swedish Riksdag for the sum of £166,000, which will be required for carrying out the proposed extension. To judge from the above-mentioned sum, it seems as if the last four sets will be considerably cheaper than the average price for the first eight sets, and this will help to reduce the cost price of the energy considerably, the more so as only one-twelfth of the whole plant need be kept in reserve, instead of one-eighth as at present. The eighth turbine and generator are now being installed, and nearly the whole of the power available has been disposed of, for which reason preparations with the view of increasing the production must be made in good time. The demand for energy by new consumers, industrial as well as private, is very lively, and there are a number of contracts under negotiation.

NORWAY.—According to the local Press, extensive work is in progress at the Glamfjord, near Bodö, for the harnessing of a waterfall capable of affording from 60,000 to 80,000 H.P. The height of the fall is not less than 500 metres.—*Board of Trade Journal.*

LUXEMBURG.—Tenders have lately been invited by the municipal authorities of Ettelbruck, in the Grand Duchy of Luxemburg, for the concession for the public electric lighting of the town during a period of 30 years.

**Cromer.**—E.L. TRANSFER.—The U.D.C. has received from the B. of T. a copy of the draft deed of the transfer of the Electric Light Order. When presented to the Council on November 11th, the clerk said it seemed to him that many of the provisions put into the agreement with Messrs. Edmundsons were struck out ; and from what he could see, the B. of T. had cut out much put in for the protection of the Council. Discussion on the matter was deferred to a later meeting.

**Crosland Moor (near Huddersfield).**—WORKHOUSE LIGHTING.—At the last meeting of the Huddersfield B. of G., reference was made to the lighting of the Crosland Moor Workhouse, and though some opposition was experienced to a resolution that electric light should be installed, a proposition was eventually carried to that effect by 31 votes to 22.

**Crowle.**—PROPOSED E.L. SCHEME.—At the last meeting of the U.D.C., letters were read from the Grassington Electric Supply Co., Messrs. T. Smith & Co., of Aberdeen, and the Kettlewell Supply Co., with reference to an electric supply in a township such as that of Crowle. After discussion, it was decided to postpone consideration of the question for three months.

**Edinburgh.**—PROV. ORDER.—The E.L. Committee has resolved to recommend the T.C. to apply for a prov. order to supply electricity to the suburban parishes of Cramond, Corstorphine, Colinton, Liberton and Newton.

**Gelligaer.**—The U.D.C. has given notice that it intends to apply for a prov. order to supply electricity within the area. Efforts will be made to secure the revocation of the Rhymney Valley and General E.L. Co.'s order in so far as it relates to the Council's area.

**Giffnock (Renfrewshire).**—The Ratepayers' Committee has instructed its representatives to request the Clyde Valley Electric Power Co. to bring its cables into the district, in order that the many new buildings recently erected, and in course of erection may have the benefit of electric lighting.

**Great Yarmouth.**—The T.C. has decided to reduce the charges for energy for heating purposes, from 2½d. to 1½d. per unit.

**Hitchin.**—PROPOSED E.L. TRANSFER.—At the last meeting of the U.D.C. a letter was read from the National Electric Co., Ltd., asking if the Council would be prepared to negotiate for the transfer of its electric lighting order to a company ; if so, the company would like to investigate the matter with the object of putting forward a proposition. A long discussion ensued, in the course of which a motion that the matter be referred to the Roads Committee for consideration was agreed to.

**Hebburn-on-Tyne.**—REPORT ON E.L. CABLES.—At meeting of the U.D.C. on the 10th inst., a report on the E.L. cables in Hebburn-on-Tyne was submitted by Prof. W. M. Thornton, of which the following is a summary :—The cables are insulated with vulcanised bitumen, and have been laid for 12 years ; they supply continuous current at 240 and 480 volts, the pressure to earth being 240 volts. The leakage upon them at the present time is large, owing to the influence of continuous current in forcing moisture through the insulation wherever the bitumen in which they were laid is cracked ; the supply company is now changing the current

from continuous to alternating, the effect of which will be to prevent the accumulation of moisture in the cables, and, after the present imperfect parts have been worked out, to stop the development of faults from this cause. This has previously been done at Monkseaton, Seaton Delaval and Hirst, with the result that trouble with cables has entirely ceased at each of these places, where before it was serious. The high-pressure cables are quite satisfactory, and no trouble may be expected from them. The cables were exposed at two places, in Cuthbert Street and Swindon Street, and were found to be in good condition. The foundations of the houses were also much better than in Lyons Street, where they were made of large open stones. Three lengths of cable were tested. Two pieces 6 ft. long were buried in earth after a bare place had been cut on each. Pressure at 240 volts, both continuous and alternating, was then applied for five days, and the cable exposed to continuous current was found to have been much more destroyed than that to which the alternating pressure had been applied. A 15-ft. length, which had not been otherwise cut, was buried in its trough with bitumen and wood complete, and withstood 1,000 volts alternating for a quarter of an hour. It was then tested for breakdown, and failed at 10,000 volts after a minute. Except where there are existing faults, the cables may then be expected to have many years of life with alternating current, and after the present faults have been removed there will be practically no risk of disasters similar to that in Lyons Street. Before dealing further with the cables laid, a three months trial should be given to the new system. The Council decided to hold a special meeting to further consider the report, on the 27th inst., at which Prof. Thornton has been asked to be present.

**India.**—An interesting historical sketch of the career of the Calcutta Electric Supply Corporation, Ltd., has recently been issued by the directors.

The Calcutta Electric Lighting license of 1896 was granted to Messrs. Kilburn & Co., agents in Calcutta for Messrs. Crompton, the preliminary concern being known as the Indian Electric Co., Ltd.; in 1897 the name of this company was changed to its present one, and in 1899 current was first supplied from a 1,000-KW. station in Emambagh Lane. Additional generating stations were opened at Alipore (750 KW.), 1902; Ultadangha (1,200 KW.), 1906; and Howrah (165 KW.), 1906, and in 1910, owing to the general development in lighting and power supply, the erection of a new H.T. power station was commenced at Cossipore, the plant being brought into use in 1912; three new sub-stations have been equipped, and the old generating stations are now provided with suitable A.C.-D.C. transforming plant. To serve the Howrah sub-station, two 1,000-KW. cables had to be laid across the River Hooghly.

At the end of 1912 there were 230 miles of underground, and 124 miles of overhead mains, a total of 354 miles in use.

There were supplied over 40,000 ceiling fans, 370,000 8-C.P. lamps, and nearly 2,000 motors, varying from ¼ to 300 H.P. in size.

The output sold for 1912 was 12,043,398 units, which figure, it is expected, will be very largely increased now that modern plant is at the disposal of the company.

It may be added that only a small percentage of the 60,000 H.P. in Calcutta mills, &c., is being supplied at present.

**Leeds.**—Half-Year's Result.—A summary of the E.L. accounts for the half-year ended September 30th, shows that the revenue amounted to £54,814, as compared with £46,047 for the corresponding period of last year, but working expenses and loan contributions (calculated for half a year) increased more than proportionately, so that the half-year's result was about £300 worse than for the same period last year. The sales of current for private lighting purposes show a greater increase than has occurred since the introduction of metal-filament lamps six or seven years ago; this increase was to some extent due to the reduction of price which took effect on October 1st, 1912, and the growth of the output has more than neutralised the loss in the price, the revenue from this source having increased by £1,011. The increase in the number of units sold was 311,532 (20·55 per cent.), which compares with the increase of 265,956 units over the whole of the preceding year. The growth of the power supply was beyond all precedent, the units sold for power and heating purposes being 2,334,622 (37·57 per cent.) more than in the first half of the year 1912-13. The aggregate capacity of the motors installed on consumers' premises has grown during the half-year from 22,096 H.P. to 24,470 H.P., an increase of 2,374 H.P. (10·74 per cent.). The increase during the past 12 months has been 4,540 H.P. (22·82 per cent.). The consumption of current per H.P. of the motors, &c., connected has been 339 units, compared with 325 units per H.P. in the previous corresponding half-year. The sales of energy to the tramways department for traction purposes have also increased, and arrangements are in progress for facilitating a further growth in this direction. The total sales for the half-year, 12,858,263 units, show an increase of 33·54 per cent. over the sales for the first half of 1912-13, and the total income was greater by 19 per cent.

**London.**—Woolwich.—The L.C.C. has sanctioned the borrowing by the B.C. of £1,500 for mains, £1,100 for services, £630 for meters, and £1,000 for hire-purchase. Application is to be made for sanction to borrow £2,875 for main extensions.

Bermondsey.—The Finance Committee of the B.C. reports that the assessment of the profits of the electricity undertaking, for income-tax purposes, had been agreed with the Inland Revenue authorities at £4,367, after allowing for depreciation of machinery and plant.

**Loughborough.**—The L.G.B., before sanctioning the proposed loan for extensions, has informed the T.C. that the proposed change of system from direct to alternating current required the approval of the B. of T., and it would defer its consent until the approval had been obtained. Approval has been applied for.

**Newcastle-on-Tyne.**—A meeting of the electrical section of the Newcastle-on-Tyne and Gateshead Chamber of Commerce was held on the 17th, when a discussion took place on the Electric Lighting Bill, which it is expected will be promoted in Parliament next Session. A communication was read from which it appeared that although there are no external evidences of progress being made, the interested parties are undoubtedly coming together, and it is anticipated that the promotion will be successful. It was thought that it would not be surprising if the Government took up the measure. In the meantime the only new clause suggested is one giving to contractors hiring-out apparatus to consumers, the same protection as is provided to local authorities under the Electric Lighting Acts, *i.e.*, to exempt them from distraint. It was resolved that the question of tariffs for cooking and lighting should be dealt with at the next meeting of the Section.

**Newcastle-under-Lyme.**—Last week a series of demonstrations of electrical cooking was given in the town, by Mr. F. S. Grogan.

**New Zealand.**—The municipality of Feilding has decided to borrow £10,000 for electric light and power purposes.—*N.Z. Shipping and Commerce.*

**Pontefract.**—The B. of G. has entered into an agreement with the tramway company *re* the provision of electrical energy, and a sub-Committee has been appointed to interview the general manager and to report thereon.

**Sheffield.**—On Thursday morning last week, a cable burn-out occurred in connection with the large and most recently installed turbine in the power house of Messrs. Vickers's River Don Works, and, as flames appeared, the power was shut off, and the works brigade extinguished the fire. The remaining turbines were also shut down, but later in the day work was partially resumed.

**South Africa.**—In connection with our reference last week, to the large electrical winder for the East Rand Proprietary Mines Co., Ltd., we are informed that the order for the electric equipment has been placed with the British Westinghouse Co. This comprises two 1,500-B.H.P. 550-volt 33·4-R.P.M., D.C. motors direct coupled to the winding drum, one on either side. These are supplied with current from a motor-generator set operating on the Ward-Leonard system, and comprising a 4,200-B.H.P. three-phase 25-period 3,000-volt A.C. motor direct-coupled to two 1,375-KW. 550-volt D.C. generators, with a direct-coupled exciter for the generators and the winding motors. All the necessary control gear and switch-gear are also being provided by the electrical contractors.

The Municipality of Prince Albert (Cape Province) has obtained the approval of the ratepayers to raise a loan of £10,000 for lighting the town by electricity, and other works.—*Board of Trade Journal.*

**South Hetton and Haswell.**—On November 13th the electric lighting question was discussed by the Local Ratepayers' Association, at whose meeting a representative of the Electric Supply Co. attended, and gave particulars regarding a supply, together with the scale of charges. It was explained that there was already a sub-station at South Hetton, removing any difficulty regarding the supply there, but in respect of Haswell, a sub-station would have to be erected at a large cost. It was decided to await further particulars, and to take steps to ascertain the probable number of consumers in the district.

**Southend-on-Sea.**—Recently 40 members of a local yacht club enjoyed an electrically-cooked dinner, the arrangements for which were made by Messrs. Gillespie & Beales at the request of Mr. Birkett, the borough electrical engineer.

**Slaithwaite.**—The U.D.C. has decided to apply for a prov. order to supply electricity within the Council's area.

**Swinton.**—The improved system of electric lighting along the South Lancashire tramway route is now completed. Instead of two 34-C.P. lamps on each pole, there are two 100-C.P. lamps.

The Council has declined to accede to a request contained in a petition from residents that the electricity supply should be extended to the Moorside district. To give the supply would entail a loss.

**Tasmania.**—The Government has decided to purchase the works of the Hydro-Electric Co. It is estimated that it will require about £70,000 to complete the scheme. The company is to have its share capital returned with a deduction, but will receive £46,000, which has to be spent in starting carbide and metallurgical works.

**Torpoint (Devon).**—The U.D.C. has obtained counsel's opinion as to the legal points raised in respect of the agreement relative to the E.L. scheme for the town, and has decided to discuss the whole matter *in camera*

**Taunton.**—On October 31st the Mayor opened a first instalment of 12 Workmen's Dwellings, which have cost £143 each; in addition to water, rates, &c., the unrestricted use of a 25-C.P. (30-watt) electric lamp in the living room (so placed as to shine into the scullery when the door is open) is included in the rental of 4s. per week, for which it is understood that the Electricity Department is to receive 3d. per week per house. Assuming four hours' average use per day, this will work out at something over 3d. per unit.

**Troon (Ayrshire).**—Proposed E.L.—The T.C. is considering the question of the lighting of the town by electricity, and is to approach the Councils of Ayr and Kilmarnock as to the terms upon which a supply would be provided.

**Tynemouth.**—The Corporation accounts for the past year state that in the electricity department the gross income was £19,157, a record for the works. The trading expenses amounted to £11,942. The net profit on the year's transactions was £944, reducing the outstanding deficiency to £701.

**Uruguay.**—The office of Traffic and Conservation of the Port of Monte Video has reported to the Council of Administration of the port recommending the purchase of five more electric cranes.—*Review of the River Plate.*

**Wakefield.**—The City Council has decided that on and after April 1st, 1914, the price of electricity for lighting should be reduced from 4½d. to 4d. per unit. At the meeting the chairman said the department had rounded the corner, and would, no doubt, reap advantage in the future by reason of the reduction in price.

**Wallasey.**—L.G.B. Inquiry.—Mr. T. C. Ekin conducted an inquiry on Tuesday, last week, into applications by the Corporation to borrow £65,000 for the extension of the electricity works. Mr. W. H. Cook, the town clerk, explained that the department was in an excellent financial position, and there was a distinct demand for electricity by large power users. Two or three large flour mills had made inquiries for a supply of energy, and factories and further mills might be expected to be erected on vacant land at Seacombe, especially if the Corporation was able to offer the owners facilities for a cheap supply of power. The site of the new generating station was in Dock Road, Seacombe, adjoining the gas works, and it was proposed to disuse the Seaview Road station as a generating station, but to utilise it as a transforming and converting station. It was stated that the outstanding debt on the works it was proposed to scrap was about £24,000. Alderman Dawson, chairman of the Finance Committee, explained that three years ago they got above their statutory maximum reserve, and instead of placing £1,000 to it, they had to contribute £150. They were also limited in their profits to 5 per cent. Up to March 31st last the reserve fund was £9,169. With interest and the present year's contribution it would be £10,500 next March, and by the time they wanted to use it for the present proposal he assumed that it would be at least £11,500. That would leave a shortage of £12,500 on the £24,000. The price of electricity had come down during the last ten years, from 5d. to 3½d. per unit. The original debt on the plant was £92,000. They had repaid £30,000, and in March last there was £62,000 unpaid. The outstanding debt on buildings not affected by the proposition was £11,000, and the total outstanding debt in March last was £73,000. Of that sum the debt on plant, which would remain on buildings and land which were not affected by that proposal, was £49,000, and the amount of the debt upon plant proposed to be scrapped was £24,000. This £49,000 was live debt and £24,000 dead. The Council asked for a scheme for £65,000, and perhaps the Board would grant a loan of £41,000 under ordinary conditions and a further loan of £12,500 for five years to help them over the stile. That would use the £11,500 in reserve to complete the £24,000 required.

Another application was for the approval of the Board of the re-allocation of land in Seaview Road, Liscard, for purposes of the electricity and tramway undertakings. The land, it was stated, was required by the Tramways Committee as a site for new workshops, and is at present held by the Electricity Committee.

**Warrington.**—In connection with the extension of the electricity works at Howley, the Electricity and Tramways Committee has accepted tenders for additional plant and buildings at a total cost of £14,550.

**Waterloo-with-Seaforth.** — The Liverpool District Lighting Co., Ltd., has informed the U.D.C. that the directors have decided to increase the price of energy for lighting by 1d. per unit from December 1st next, making the standard rate 6d. per unit instead of 5d. There will be no advance in the price of current for heating, cooking, or power.

**West Bromwich.** — The T.C. has decided to supply electricity for lighting and power to Johnson's Iron and Steel Co., Ltd., at ½d. per unit, on a guaranteed minimum demand equal to £500 per annum for five years.

**Weston-super-Mare.**—Public Lighting.—At a meeting of the U.D.C. the question of the lighting of the boulevard with gas or electricity was discussed. The Council had before it an offer from the Weston-super-Mare and District Electric Supply Co., for lighting the boulevard with four centrally suspended lamps and six other lamps hung at intermediate points in pairs, the total guaranteed candle-power of these lamps to be not less than 3,600. The price quoted for this installation was £42 per annum on a five years' contract. The Gas Co. also quoted, but it was resolved to accept the terms offered by the Electric Supply Co.

## TRAMWAY and RAILWAY NOTES.

**Ashton.**—Representatives of the Tramways and Highways Committees of the Corporation have made the following arrangements for the maintenance of the tramways for three years:—The Tramways Committee to contribute to the Highways Committee £550 per annum to cover cost of maintenance of the tramways; to pay the actual cost for materials and labour necessary in case of renewals, and to provide all rails, points or any other steelwork required; no renewals to be executed without first being reported to the tramways department.

**Argentina.**—The Government has been authorised to grant concessions to the Lacroze Tramway Co. for constructing and working branches to its existing electrical tramway system, the branches to be not more than 20 km. each in length. The company has forwarded plans for 12 such branches, and the necessary contract will be prepared.

The Government of the Province of Cordoba has forwarded to the Provincial Legislature a petition from the South American Railless Traction Co., in which it applies for a concession for working this system in various cities in the province.

Mr. J. Basante has applied to the Municipality of Villa Rica for a concession to establish a telephonic service between the town and the railway station, also for tramway and electric lighting concessions.—*Review of the River Plate.*

**Australia.**—According to the *Standard*, Messrs. Jones and Molomby, officials of the Victorian Government Railway Department, are coming to London shortly, to obtain an insight into the methods of working the electric railways, in view of the electrification of the Melbourne suburban lines, which is now in progress.

**Bradford.**—The protests made in the city with regard to platform fare collection on the tramcars has not been without its effect, for the Tramways Committee has decided to experiment with the invention of a local conductor, who has patented a device which, it is hoped, will obviate the crowding of passengers on the car platform. The idea is a "change bag" containing a number of pockets each containing the requisite amount of change according to the silver tendered. It is thought that by the adoption of this idea the inevitable delay resulting from the necessity of sorting and counting the change will be obviated.

**Bury.**—With a view to doubling the tramway in the main streets, the T.C. intends to apply to the L.G.B. for a prov. order giving it powers to compulsorily acquire lands for the purpose of widening nine roads and streets.

**Chesterfield.**—The T.C. is seeking powers to construct two lines of electric tramways, one to extend from the junction of Sheffield Road and Newbold Road, to join an existing line in the latter thoroughfare, and the other to extend from Sheffield Road to the parishes of Newbold and Whittington.

**Chile.**—According to the *Review of the River Plate*, the Government is anxious to arrange for the electrification of the railway between Santiago and Valparaiso as soon as possible.

**Continental Notes.**—Italy.—The construction of the electric railway from Milan to Genoa will be commenced as soon as the Chamber of Deputies has granted the £6,000,000 necessary for this work. At present the great difficulty is to decide upon the exact course which the line is to take, as several plans have been proposed whereby the original track of about 94 miles is to be shortened by from 12 to 16 miles.—*Board of Trade Journal.*

Germany.—The Mackenzie, Holland and Westinghouse electric signalling system has been installed on the Spittelmarkt-Alexanderplatz section of the Berlin Hoch und Untergrundbahn.

Denmark.—A Danish engineer from Aarhus has recently invented an electrical system, by means of which the stopping signals of the railways are put into direct connection with the brakes of the trains. It will thus become possible at any time to stop the trains from the nearest station, whenever it may be required, and no matter where the train may be at the moment. The Danish State Railways have agreed to carry out the necessary experiments in order to ascertain whether the system can be adopted in the service.

**Glasgow.**—The Tramways Committee is to consider a proposal for the replacing of the present sign-plates for stopping places with illuminated signs.

**Gloucester.**—The T.C. has approved of the proposal to place the tramways under the management of Mr. F. H. Corson, the borough electrical engineer, and a sub-committee has been asked to report on a detailed scheme.

**Japan.**—Railless Traction Schemes.—It is announced from Tokio that a company is in course of formation there with a capital of £300,000, and the title the Railless Electric Tramway Co., to introduce the railless traction system into Japan. It is proposed to establish such lines in Tokio, Yokohama, Shidzuoka, Nagoya, Utsunomiya and Sendai.

**Leith.**—Tramways Extensions.—A report prepared by the tramways manager, the burgh surveyor, and the burgh chamberlain on the question of tramways extension, has been submitted to the Tramways Committee of the T.C. It is pointed out that a tramway along Bonnington Road from Great Junction Street would naturally have to be considered in the event of Edinburgh Corporation promoting a scheme of tramways along Broughton Road westwards, but meantime it was understood the proposal was to run motor-'buses on that route. In the southern district extensions that might be considered were (1) Seafield and Portobello; (2) Salamander Street; and (3) Easter Road and Iona Street. The extension to the top of King's Road, Portobello, appeared to be the most feasible which had been considered. Regarding the Salamander Street extension, it was stated the cost of a single line from Bernard Street to the existing Seafield car terminus would be about £10,500, and of a double line about £15,500.

**London.**—Bermondsey.—The General Purposes Committee of the B.C. has reported on the proposal of the L.C.C. as to the horse tramways in Southwark Park Road. In November last the Borough Council was asked to consent to the electrification of the tramway on the overhead system, and it refused consent to any system other than the conduit. A few weeks ago representatives appointed by the B.C. interviewed several members of the L.C.C. with regard to the matter, and it appears that the sole reason why the L.C.C. desired not to reconstruct the tramways on the conduit system was one of expense in the matter of street widenings, which would be approximately £60,000 more than if the overhead system was adopted. Having fully considered this point, the Committee has decided to inform the L.C.C. that in its opinion it would appear from the figures submitted as to the relative cost of the two systems that the L.C.C. proposes in connection with the overhead system of electric traction, to construct a line with fewer loops and more single line than would be the case if the conduit system were adopted, inasmuch as there is a difference of over £60,000 in the cost of the widenings as between the two systems, which strengthens the B.C. in its opinion that it would be inadvisable to give its consent to the overhead system.

L.C.C.—The Highways Committee, as the result of experimental trials of petrol-electric cars on the Tooley Street route, has decided that this system of traction would not be suitable for use on the Burdett Road—Grove Road route as originally proposed.

Electric Ambulances.—At the last meeting of the Metropolitan Asylums Board, the Ambulance Committee reported having had under consideration the practicability of using electrically-driven ambulances. The Committee has always recognised that electricity provides the most suitable form of traction for ambulances employed in the conveyance of acute cases, but hitherto has not recommended the purchase of ambulances other than petrol-driven, by reason of the difficulties which the use of electric vehicles presented, and not the least of these was the excessive cost. Recent developments in electric traction have, however, caused it again to consider the question, and it now recommended that application be made to the L.G.B. for sanction to entering into a contract with "Cedes" Electric Traction, Ltd., for the supply of two chassis for £265 each, and two batteries for £80 each, without, in the first place, advertising for sealed tenders; this was agreed to.

Tottenham.—The U.D.C. has decided to have all tramway centre poles in the district removed, with the exception of those on three refuges.

Deptford.—The B.C. has reduced the rateable value of the L.C.C. tramways within the borough from £12,263 to £2,250.

We learn that the G.P.O. is carrying out some trials in the London district with one of the three-wheel Torpedo electric delivery vehicles illustrated in a recent issue.

**Ramsbottom.**—At a meeting of the Council on November 13th, it was announced that orders for two new cars for the railless system were to be placed as soon as possible, but that before doing so a small Sub-Committee intended to visit different works with a view to getting better cars than those at present in use.

**Reading.**—Tramway Extensions.—The T.C. is seeking powers to construct two new lines of tramways, one from Randolph Road to Caversham Bridge, and the other from the latter point to Church Road, Caversham, together with five routes for trolley vehicles.

**Southend-on-Sea.**—Proposed Loan.—The T.C. on November 10th decided to apply to the B. of T. for a loan of £5,000 for doubling the tramway track from the borough boundary to Leigh-on-Sea Church.

**Stirling.**—A Tramway Report.—In an exhaustive report the chief officials of the T.C. deal with the proposed electrification of the local tramways. A system of municipal tramways between Bridge of Allan and Bannockburn (about seven miles) *via* the burgh of Stirling, is dealt with, and the question of further extension to the neighbouring burghs and villages of Cowie, Danny, Dunblane, Tullibody, Cambus and Alloa, Blairlogie, Menstrie, &c., serving a total population of 65,216, is considered. The estimated cost of the scheme between Bridge of Allan and Bannockburn is £78,100, and the yearly income is set down at £9,744, while the working expenses are given at £4,981.

**Tasmania.**—The Launceston City Council has approved of a Bill authorising the Council to run railless tramways and motor-'buses, and to borrow £30,000 for tramway purposes.—*Australian Mining Standard.*

**York.**—A special meeting of the City Council was held last week to consider the advisability of applying for powers to extend the present tramway system, to run railless vehicles, and other purposes. It was decided that the Light Railway Commissioners should be asked to grant power to extend the permanent tramways from Nessgate to Hull Road, and also from the Haxby Road terminus to a point beyond the cocoa works. Clauses were inserted in the Bill dealing with railless tramways, to obtain further powers for the extension of the electricity undertaking.

## TELEGRAPH and TELEPHONE NOTES.

**Argentina.**—The United River Plate Telephone Co. has purchased the telephone businesses existing in Rio Cuarto and Bell Ville, and it is probable that these two towns will be connected up with the city of Cordoba. In the latter city the company is installing an automatic telephone exchange, the first to be erected in Argentina.—*Review of the River Plate.*

**Automatic Telephone Service.**—According to the *Times*, as the result of experience gained with the automatic telephone exchanges at the General Post Office, Epsom and Hereford, 10 additional exchanges are now being equipped, and will be in operation in a few months. These exchanges are situated in Leeds, Portsmouth, Newport (Mon.), Darlington, Dudley, Accrington, Stockport, Grimsby, Paisley and Chepstow, and the system will probably be employed also at Manchester, Liverpool and Newcastle. The Portsmouth installation will deal with 5,000 lines, and that at Leeds will run into five figures. Whether automatic telephony will ever be practicable in London is doubtful.

**French Indo-China.**—A sum of 596,800 fr. has been allocated by the Government for the construction of a wireless telegraph station at Saigon.—*Board of Trade Journal.*

**International Conference.**—The International Conference on the Safety of Life at Sea was opened in London last week. One of the subjects that will be dealt with is that of wireless telegraphy on board ship.

**Norway.**—The wireless station at Rundemanden, in the neighbourhood of Bergen, has now been one year in operation, and has successfully passed the severe trials of a Norwegian winter on the coast of the North Sea. It has been found necessary, on account of the experience gained, to make some improvements, among which may be mentioned the erection of four masts of a height of 42 m., at a distance of about 100 m. to the north, south, east and west of the iron tower, to support the antennæ radiating from the top of the tower. Previously the wires were stretched over a distance of 250 m. from the top of the tower to short masts of wood. During the heavy storms of last winter they were frequently broken, and although they were easily repaired, the station was put out of action while the repairs were going on. The power cable has been strengthened in those places where it was most exposed to the weather, as interruptions often took place, but it is thought that such will be prevented during this winter. The attendants are now prepared to face practically anything in the way of severe weather without fear of the station being put out of operation.

**Richmond.**—The T.C. is entering into an agreement with the Post Office, for a period of five years, for utilising the telephone system for the purposes of fire calls.

**Telegraphy and the Panama Canal.**—The *Telegraph and Telephone Age* of November 1st tells how the dike at Gamboa, on the Panama Canal, was removed by a huge blast of dynamite.

The Western Union Telegraph Co. utilised a circuit from Washington to Galveston, a distance of 1,556 miles. At Galveston, connection was made with the Mexican Telegraph Co.'s cable to Coatzacoalcos, 792 miles, thence over the landline across the Isthmus of Tehuantepec to Salina Cruz, 163 miles. At Salina Cruz, the circuit continued through the Central and South American Telegraph Co.'s cable to San Juan del Sur, Nicaragua, 690 miles, thence to the company's station at St. Elena, Ecuador, 1,034 miles. The last stretch of the cable circuit from St. Elena to Panama was 920 miles. At Panama, the cable was connected to Gamboa dike, a 17-mile landline, furnished by the Panama Railroad Co.

At all the cable stations Muirhead gold-wire cable relays are used, and the closing of the key at Washington by President Wilson sent the blasting signal direct to the dynamite charge at Gamboa dike without the intervention of human hands. When the relay at Gamboa was thus closed, the charge in the dike immediately exploded, thus practically completing the greatest engineering feat in the history of the world.

President Wilson closed the key at Washington at 2.01 p.m., and the explosion took place at 2.02. The return signal announcing the success of the event was received at New York at 2.02½. The total length of the circuit from Washington to Gamboa dike was 5,172 miles, and the length of the return circuit *via* Colon to New York was 2,310 miles.

**Wireless Amateur Convicted in U.S.A.**—The first case of violation of the Radio-communication Act of August 13th, 1912, was recorded on October 20th, in the United States District Court, New York. Herbert Myers, of Ninety-fourth Street, New York, was charged with violating the law by using wireless apparatus which would affect inter-State communication, without having obtained the necessary licence. He had been warned by the radio inspector, but he disregarded the admonition. He was fined $50 by Judge Mayer and ordered to destroy the apparatus.—*T. and T. Age.*

**Wireless Heroes.**—At Marconi House on November 13th, in the presence of a large number of students attending the day classes at Marconi House and others connected with the company, Mr. G. Marconi presented gold watches to the operators on the *Volturno*, Mr. W. Seddon and Mr. C. J. Pennington, and also to the operator in charge on the *Templemore*, Mr. R. Emanuel, in recognition of the manner in which they carried out their duties on the occasion of the burning of these vessels.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—Sydney (New South Wales).—March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" October 31st.

December 31st.—For the P.M.G. Insulators. See "Official Notices" October 31st.

December 22nd. Melbourne Suburban Railways. (1) Track feed boxes, including signal transformers, switchgear and accessories. (2) Track resistances. (3) Impedance bonds. (4) Track relays and relay boxes. See "Official Notices" November 7th.

**Aberdeen.**—November 27th. Great North of Scotland Railway Co.—Tenders for supply during 6 or 12 months of electric light materials. Particulars (1s.) from the Stores Superintendent, 80, Guild Street, Aberdeen.

**Belgium.**—Neufchateau.—December 1st. Tenders are invited for a concession to establish and work an electric installation. Deposit, 5,000 fr. Particulars from the Hotel de Ville, Neufchâteau.

Antwerp.—January 27th. Supply and erection of six electric cranes for the harbour at Antwerp. Deposit, 20,000 fr. Particulars (0.30 fr.), Hotel de Ville, Antwerp.

**Birkenhead.**—December 2nd. Corporation. Twelve months' supply of electric motors and motor-starters, from ¼ to 15 H.P. See "Official Notices" to-day.

**Chatham.**—November 27th. The T.C. is inviting tenders for the supply during 1914 of incandescent electric lamps; the Borough Surveyor, Town Hall.

**Crompton.**—January 10th. Refuse destructor, for the U.D.C.; Mr. F. F. Garside, Surveyor (returnable deposit of £2 2s.).

**Durham.**—November 27th. Sewage-screening apparatus and fixing of electrically-driven machinery, for the T.C.; Taylor and Wallin, engineers, Cathedral Buildings, Newcastle-on-Tyne (returnable deposit of £2 2s.).

**Edinburgh.**—The Commissioners of Works invite tenders for the execution of the electric bell work in the buildings in their charge in the Edinburgh district during a period of three years from January 1st, 1914. H.M. Office of Works, Storey's Gate, London, S.W.

**France.**—Paris.—November 26th. Supply of requirements of apparatus parts for three years, in one lot; Sous-Secrètariat des Postes et Télégraphes, 103, Rue de Grenelle, Paris.

**Gateshead.**—November 25th. Electric lamps, electric wires and cables, electrical sundry fittings, arc lamp carbons, glasses for electric arc lamps, &c., for the North-Eastern Railway Co. Mr. E. H. Clark, Stores Superintendent, Gateshead.

**Hungary.**—Tenders have just been invited by the municipal authorities of Brasso for the establishment of a central electric lighting station in the town.

**Italy.**—Rome.—November 25th. Supply of an 80-ton capacity travelling bridge, to lift locomotives for the Rimini machine shop. International adjudication. Italian State Railways Bureau, Rome.

**London.**—L.C.C.—November 26th. Installation, 140 lighting points, at Hammersmith Trade School for Girls, Lime Grove. See "Official Notices" November 7th.

November 26th. Installation, 240 lighting points, at Lancaster Road Elementary School, Notting Hill, W. See "Official Notices" November 14th.

December 3rd. Installation, 225 lighting points, at Chester Road Elementary School, St. Pancras, N.W. See "Official Notices" to-day.

Fulham.—November 26th. Corporation. 2,500-kw. turbo alternator and condensing plant. See "Official Notices" November 14th.

Shoreditch.—December 16th. Corporation. Sub-station plant (transforming and converting plant, starting and controlling apparatus). See "Official Notices" to-day.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" to-day.

**Manchester.**—November 28th. Corporation. Two water-tube boilers and superheaters, economisers, coal chutes, ash conveyor, pipe connections, additional stoker shafting and clutches, and pneumatic ash-handling plant at boiler house No. 2, Stuart Street generating station. See "Official Notices" November 7th.

**New Zealand.**—January 5th, 1914. The Christchurch City Council invites tenders for series street-lighting plant (1,950 metallic-filament lamps) and accessories. A specification can be seen at the B. of T. C.I. Department in London.

December 31st. Auckland Harbour Board; Electric winch for 600-ton slipway.—*Tenders.*

**Plymouth.**—December 1st. Corporation. Contract No. 31. Ironclad high-tension switch panels. See "Official Notices" November 14th.

**Pontypridd.**—November 25th. Electric light installation. Cottage Homes, for the B. of G. Mr. Wm. Spickett, clerk; (returnable deposit of 10s. 6d.).

**Rainhill (near Liverpool).**—November 24th. Wiring and fittings for new ward, Lancashire County Asylum. See "Official Notices" November 7th.

**Spain.**—December 29th. The Harbour Works authorities at Valencia are inviting tenders for an electrically-operated elevator for the unloading of wheat and other food stuffs.

The municipal authorities of Saldana (Province of Palencia) are at present inviting tenders for the concession for the electric lighting of the town during a period of ten years.

**Torpoint.**—November 26th. Public lighting, for the U.D.C.; Rolands & Beaumont, engineers, Council Offices.

**Turkey.**—The Turkish Ministry of Posts and Telegraphs in Constantinople is at present inviting tenders for the supply of 12 reels, each 1,643 ft. long, of 16-conductor paper-insulated submarine cable.

**Wakefield (Yorks.).**—December 5th. Twelve months' supply of stores, for Yorkshire (West Riding) Electric Tramways Co., Ltd.

**West Hartlepool.**—December 3rd. Corporation. Car bodies and trucks; electrical equipments for cars; points and crossings. See "Official Notices" to-day.

**York.**—November 25th. Telegraph apparatus, telegraph wire and line stores, for the North-Eastern Railway Co.; Mr. C. H. Ellison, Telegraph Superintendent, York.

### CLOSED.

**Australia.**—The following tenders have been accepted by the Commonwealth:—

Melbourne.—

250 tons hard-drawn copper wire, 200 lb. per mile, £85 6s. per ton, £21,325.—B.I. & Helsby Cables, Ltd.
500 magneto telephones, £1,289; 50 Morse keys, £50; 1,200 lb. Blake's insulated staples, £177.—I.R., G.P. & Telegraph Works Co., Ltd.
200 common-battery table pattern telephones, £247; 1,000 wall-pattern telephones, £1,500; 500 common-battery telephones, with generators, £1,410; 100 telephonometers, £125; 75 telephone sets, £94; 1,300 common-battery table telephones, £1,603; 500 common-battery wall telephones, £631; 3,500 common-battery wall telephones, £5,206.—Western Elec. Co., Ltd.
300 common-battery table telephones, £720; 150 magneto table telephones, £375.—J. Bartram & Son Pty., Ltd.
25 miles wire, two twisted conductors, £112.—John C. Fuller & Son, Ltd. (J. Paton & Co.)
100 Obach cells, £7 10s.; 6,300 dry cells, £646.—A. J. Sage & Co.

Sydney.—

Eight multiple magneto switchboards, £2,752; spare equipment, £276; 2 miles 42-wire switchboard cable, 1s. 4d. per yd.; ½ mile 63 wire switchboard cable, 1s. 10d. per yd.—James Paton & Co.

*Australasian Record.*

Kadina Corporation (S.A.):—

68-kw. D.C. generator, by Electric Construction Co., £461.—Newton McLaren, Adelaide.
Tudor battery, 125 cells, £674; and motor-driven booster, £110.—Australian Metal Co.
100-144-B.H.P. Premier gas engine, direct coupled, two-cylinder, w suction gas producer, £1,315.—Clutterbuck Bros.—*Tenders.*

Melbourne.—The P.M.G. has accepted the following tenders for submarine cable:—

Ten nautical miles, shore end, £3,422; 10 nautical miles, intermediate type, £2,020; 10 nautical miles, main or deep-sea type, £1,310.—W. T. Henley's Telegraph Works Co., Ltd.—*Australian Mining Standard.*

Department of Home Affairs, N.S.W.—Transformers for the power plant; Federal capital, £1,214.—Australian Metal Co., Ltd. —*Australian Mining Standard.*

The Melbourne City Council has accepted the tender of Messrs. Siemens Bros. Dynamo Works Co., Ltd., for the supply of insulated copper cables. A quotation at a figure £180 below that of Siemens Bros. was submitted by A.E.G. Co., but the Council gave preference to British manufacture, and therefore accepted the higher figure.—*Tenders.*

**Barnsley.**—The Corporation has placed a repeat order with Messrs. Edward Bennis & Co., Ltd., for four of their machine stokers and self-cleaning compressed-air furnaces for the electricity works.

**Canada.**—The *Canadian Electrical News* reports the placing of contracts as follows:—

OTTAWA, ONT.—Ottawa and Hull Power and Manufacturing Co. have decided to increase their power plant by the addition of two water-wheel type alternators, each 6,750 K.V.A., 120 R.P.M., 2,300 volts, and also two transformers, each 6,750 K.V.A., 2,300-12,000 volts. Contractors, the Canadian General Electric Co., Ltd.

CALGARY.—The Imperial Wire and Cable Co. Supply of 40,000 ft. of lead-covered, paper-insulated underground cable.

ROUGEMONT, P.Q.—Equipping the sub-station at Rougemont, P.Q., of the Montreal and Southern Counties Railway; a 300-KW. motor-generator set, a bank of transformers, high and low-tension switchboards, lightning arresters and switching apparatus. Contractors, the Canadian General Electric Co., Ltd.

SWIFT CURRENT, SASK.—A contract for the erection of a new power house has been awarded to G. C. Gillstrom Contracting Co.

**Highfield.**—The Walsall Electrical Co., Ltd., have received the order for the switchboard for Highfield Infirmary from Messrs. Dargue Griffiths.

**Government Contracts.**—The following tenders have been accepted during the past month by the Government Departments named:—

WAR OFFICE.

Electric cable and wire.—B.I. and Helsby Cables, Ltd.; Hooper's Telegraph and I.R. Works, Ltd.; Johnson & Phillips, Ltd.; London Electric Wire Co., and Smiths, Ltd.; Midland Electric Wire Co., Ltd.; St. Helens Cable and Rubber Co., Ltd.; Siemens Bros. and Co., Ltd.
Copper conductors, &c.—Western Electric Co., Ltd.

POST OFFICE.

Telegraphic apparatus.—Gell Telegraphic Appliances Syndicate, Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; International Electric Co., Ltd.; Western Electric Co., Ltd.
Submarine cable.—W. T. Henley's Tel. Works Co., Ltd.; Siemens Bros. and Co., Ltd
Telegraphic cable.—W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephonic cable.—W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Ducts.—Oates & Green, Ltd.
Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.; Taylor, Tunnicliffe and Co., Ltd.
Telegraphic ironwork.—Baldwins, Ltd.; Bullers, Ltd.; J. Elwell, Ltd.; D. Willetts, Ltd.
Insulated tails.—Estler Bros.
Bronze wire.—F. Smith & Co., Inc. in London Electric Wire Co. and Smiths, Ltd.
Electric light wire.—B.I. and Helsby Cables, Ltd.
Flameproof wire.—London Electric Co., and Smiths, Ltd.
Vulcanised india-rubber wire.—Johnson & Phillips, Ltd.
Electric lifts, Glasgow.—Gimson & Co. (Leicester), Ltd.

INDIA OFFICE: STORE DEPARTMENT.

Wireless telegraphy apparatus.—Marconi's Wireless Telegraph Co.
Motor-alternator.—Lancashire Dynamo, &c., Co.

CROWN AGENTS FOR THE COLONIES.

Electric light fittings for railway carriages.—J. Stone & Co., Ltd.
Electric train staff instruments.—Railway Signal Co., Ltd.
Engine pumps.—Rees Roturbo Manufacturing Co., Ltd.
Telephone wall sets, &c.—Western Electric Co.

COMMISSIONERS OF PUBLIC WORKS, IRELAND.

Buildings, alterations and additions to, Corkbeg Wireless Telegraph Station, Co. Cork.—J. J. Healey.

**London.**—L.C.C.—The Highways Committee has received tenders for the supply of six motor-cars required for use in the tramways department, and for the purchase of the six cars now used. The offer of the Enfield Autocar Co., Ltd., of Birmingham, at £1,986 (less £210 offered for the six present cars) is recommended.

The Metropolitan Asylums Board is about to enter into a contract with the "Cedes" Electric Traction, Ltd., for the supply of two electrically-driven ambulance chassis for £265 each, and two batteries for £85 each.

STOKE NEWINGTON.—The tender of the British Thomson-Houston Co., Ltd., has been accepted by the B.C. for a biennial supply of meters of assorted sizes.

BERMONDSEY.—The following tenders have been accepted by the Council:—

B.I. and Helsby Cables, Ltd.—Two-way feeder pillar.
Sykes & Sugden, Ltd.—Seven-way disconnecting box (including patterns).

**Loughborough.**—Subject to sanction to a loan being obtained, the T.C. has accepted the following tenders for plant, &c., for the electricity works:—

Siemens Bros.—Rotary converter and switchgear.
Brush Electrical Engineering Co., Ltd.—Ljungstrom Turbo-alternator, with condenser and transformer.
Swan, Ratcliffe & Co.—Boiler seatings.
H. Hammond.—Extensions to buildings.

**Runcorn.**—The U.D.C, has accepted the tender of the British Westinghouse Electric, &c., Co., Ltd., for the supply of spare parts for pumps, motors, &c., at the waterworks, at £33.

**Sleaford.**—The U.D.C. has accepted the tender of Messrs. Pattinson for coal for the electricity works, at 18s. per ton.

**Sunderland.**—The T.C. has accepted the following tenders:—

Union Cable Co.—Cable.
I.R. & G.P. Co.—Cable.
E. Green & Sons.—New sections and parts for economiser.
Four Synchron life-savers.

**Twickenham.**—The tender of Messrs. J. B. Marr and Co., Ltd., for alterations, &c., to the E.L. installation at the library has been accepted.

## FORTHCOMING EVENTS.

**Institution of Electrical Engineers (Newcastle Local Section).**—Friday, November 21st. At 7 p.m. At Hugh Bell School, Middlesbrough. Paper on "Steam Boiler Working in Electrical Power Stations," by Mr. J. W. Jackson.

**Manchester Electro-Harmonic Society.**—Friday, November 21st. Concert. (See "Notes" to-day).

**Junior Institution of Engineers.**—Friday, November 21st. At 39, Victoria Street. Paper on "Maintenance (Electrical)," by Mr. T. A. St. Johnston. Friday 28th. Paper on "Patent Protection," by Mr. A. Abbey.

**Garrick Dramatic Society.**—Saturday, November 22nd. At 8 p.m. At Royal Court Theatre. "The Voysey Inheritance." To assist funds of Electrical Trades Benevolent Institution.

**Institution of Electrical Engineers (Birmingham Local Section).**—Wednesday, November 26th. At 7.30 p.m. At the University. Mr. Evershed's paper. See below.

**Institution of Civil Engineers.**—Wednesday, November 26th. Students' visit, Metropolitan Railway Line—Widening works and power station, Neasden.

**Faraday Society.**—Wednesday, November 26th. At 8.30 p.m. At Institution of Electrical Engineers, Victoria Embankment. Various papers.

**Institution of Electrical Engineers.**—Thursday, November 27th. At 8 p.m. At Victoria Embankment. Paper on "The Characteristics of Insulation Resistance," by Mr. S. Evershed.

**Greenock Electrical Society.**—Friday, November 28th. At 7.45 p.m. At Temperance Institute, West Stewart Street. "Steam Turbines," by Mr. J. H. Parker; "The Entz Reversible Booster," by Mr. P. Kerr.

**North-East Coast Institution of Engineers and Shipbuilders (Graduates' Section).**—Friday, November 28th. At 7.30 p.m. At Westgate Assembly Rooms, Newcastle-upon-Tyne. Conversazione.

**Physical Society of London.**—Friday, November 28th. At 5 p.m. At Imperial College of Science. Papers by Prof. H. L. Callendar, Mr. F. J. Harlow and Prof. J. A. Fleming. Also an exhibition of a double-fibre string galvanometer, by Mr. W. Apthorpe.

**Manchester Association of Engineers.**—Saturday, November 29th. At Grand Hotel, Aysoun Street. Paper on "Pattern-making Department in an Engineering Works," by Mr. T. Roberts.

## THE ELECTRICAL ENGINEERS
### (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, November 24th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.
Tuesday, November 25th.—"B" Company. Ditto.
Wednesday, November 26th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.
Thursday, November 27th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.
Friday, November 28th.—"D" Company. Technical instruction, 7.30 to 10 p.m.
Saturday, November 29th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Captain R.E., Adjutant,
For Officer commanding L.E.E.

**Tramway Workers' Wages.**—The Highways Committee of the L.C.C. reports that an agreement has been arrived at by the Rolling Stock Conciliation Board fixing a flat rate of 30s. a week for car-washers; those already in receipt of 30s. a week for 12 months to be granted a rise of 1s. per week. Controller repairers and light power attendants are to receive a flat rate of pay of 8d. an hour.

## NOTES.

**Institution and Lecture Notes.**—Association of Mining Electrical Engineers.—At the monthly meeting on Friday last, of the East of Scotland Branch of the Association at Dunfermline, an address was delivered by Mr. C. C. Reid, Cowdenbeath, on "The Repair and General Maintenance of Electrical Plant in Collieries." The speaker referred to the great expense involved for general repairs and renewals of the average electrical installation at a colliery; he knew of no branch of mining where economy and carefulness had received less consideration than the electrical repair department. He suggested, as a remedy, that a proper electrical stores department should be kept in connection with each colliery, under the control of a person who would be responsible for the stock of spare parts, &c. His experience was that the more difficult it was for a man to get a spare part, the more disposed he was to take care of what he actually got. Proper inquiry should be made into all the leakages of electrical material, and a register should be kept for each motor at the colliery, in which particulars should be systematically entered of each repair and breakdown.

At a meeting of the West of Scotland branch of the Association, at Glasgow, on Saturday evening, Mr. J. P. C. Kivlen read a paper on "The Specifying and Buying of Mining Electrical Plant." The author's chief aim was to give prominence to a number of details often overlooked when ordering material or installing apparatus, and to offer suggestions that would be beneficial alike to manufacturer and customer. The interests of manufacturer and consumer were so closely interwoven that it behoved the former to give every consideration to the actual requirements of the latter; in turn, the consumer ought carefully to discriminate, and buy only one class of material—the best. That such consideration had not been given in the past was generally known. A great many British firms did not, or would not, appreciate mining conditions. Six copies of the specification were sent out to first-class firms for certain apparatus some time ago. These gave the manufacturer full and definite instructions as to what was wanted, with an offer of blue prints, if necessary. The result was that there were only two legitimate offers, three apologetic letters regretting inability to quote, and an offer of unsuitable stock material. The customer had also a duty to perform in that he should carefully define his requirements. If cable-makers would now arrange to give them a concentric cable with twin-shunt cores for field connecting in the case of a reversing-shunt machine, or multiple core in the case of a reversing compound-wound motor, they would confer a great boon on direct-current underground working. Straggled wiring would, as a consequence, be completely obviated. Then, again, development could not always be foreseen, and when ordering fuse or distributing-boxes, preference should be given to material that could be extended, by simply placing one piece of apparatus against another, and interconnected by bus-bars. This class of apparatus was now on the market for concentric working. Nothing smaller should be used than a 25-ampere fuse bridge. An ammeter was desirable on every motor. When ordering instruments for concentric working it should be pointed out that there was a continuous potential difference of, say, 500 volts between the working parts and the case when operating. The lack of proper appreciation of this point was responsible for 90 per cent. of the instrument failures. As regards the generator, if a new machine had to be ordered they should have it over-compounded from, say, 500 to 520 volts. A coal-cutter load was somewhat similar to a tramway load on a small system, and tramway type generators saved the necessity of voltage regulation to a large extent. They should not use fuses in the main circuits, but should instead install good trip gear. If fuses were decided on they should place them at the back of the board on brackets clear of inflammable insulation and not in line with the attendant's eyes as was usually done. Even the heaviest porcelain was sometimes wrecked. Every manufacturer should be asked to quote on the same basis. Secondhand electric machinery should be severely left alone excepting in cases of breakdown or urgency. This particularly applied to three-phase motors.

At a joint meeting of the Notts and Derbyshire branch of the Association and the Midland branch of the National Association of Colliery Managers at Nottingham, on November 8th, Mr. E. Kilburn Scott read a paper on "Large Prime Movers and Boilers for Power Houses." Amongst other items, he described boilers fired with coal dust, and with gas. Emphasising the importance of economical utilisation of our coal resources, he advocated the concentration of generating plant in very large power stations in the colliery districts, of, say, 100,000 KW. capacity, using large turbo-generators supplied with steam from gas-fired boilers, with by-product recovery plant. For a continuous load such a plant could supply energy at less than 0·1d. per unit.

Institution of Engineers and Shipbuilders in Scotland.—In the course of his presidential address on October 21st, Dr. R. T. Moore dealt with the subject of coal mining. He described electrical power transmission as the only satisfactory solution of the problem in mining, and the greatest improvement which had taken place since the invention of the steam engine. A permanent increase had taken place in the price of coal, due to increase of wages, reduction of hours of labour, legislation, and exhaustion of the cheaply-worked seams. Since the Eight Hours Act came into force the output per person employed underground in the United Kingdom had fallen from 374 tons per annum in 1906, to 311 tons in 1912, in spite of the increase in number of mechanical coal-cutters from 1,652 in 1908 to 2,444 in 1912. At the present rate of increase of output, the coal supplies of this country and the Continent would last for 300 years; the world's store of coal for 600 years. While Great Britain contained 189 thousand million tons, Canada possessed 1,235 million tons, and the President suggested that within 300 years long-distance electrical transmission across the Atlantic might be possible. Every endeavour, he said, should be made to save the coal, and the erection of large central electric stations for the distribution of power tended in that direction.

At a meeting of the Victorian Institute of Electrical Engineers on October 2nd, a paper was read by Mr. E. B. Brown, M.Sc., on "Electric Speedometers and Tachometers."

Junior Institution of Engineers.—On Monday a paper was read by Mr. Ernest King on "The Institution and its Work," concluding with the following summary of the progress of the engineer who joins it:—"He begins by receiving help, he continues with helping himself, he ends in helping others, and in thus helping others he experiences what is undoubtedly one of the great 'pleasures of life.'"

Leicester Association of Engineers.—On Friday last Mr. C. G. Conradi read a paper on "Workshop Electrification."

The North-Western Centre of Post Office Electrical Engineers held a meeting at Preston last week, when a lecture on "Automatic Telephony" was given by Mr. B. O. Anson, automatic telephony expert attached to the Engineer-in-Chief's office, London.

Iron and Steel Institute.—The next annual meeting and the annual dinner will take place on May 7th and 8th, 1914. The autumn meeting will be held in Paris, September 18th and 19th having been provisionally fixed for the business sessions.

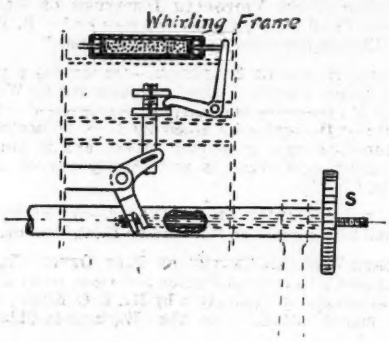
**Electricity Supply Rifle League.**—The following matches were decided during October:—Brompton (Mugford, 99), 568; *v.* Ilford (Bailey, Haeger, 97), 573. Brompton (Willis, 98), 567; *v.* Westminster (Neville, 98), 578. Central (Gaze, Robinson, Wells, 96), 570; *v.* Ilford (L. Tuffnell, 97), 552. Central (Gaze, Law, 97), 566; Shoreditch (Ebner, 97), 566. Hackney (Self, 96), 565; *v.* Poplar (Randall, 92), 527. Hackney (Hilling, 98), 551; *v.* St. James's (Cockburn, 99), 552. Poplar, 528; *v.* St. James's (Cockburn, 97), 549. Shoreditch (Weekes, 95), 559; *v.* Stepney (Dubbib, 97), 553. Stepney (Heaviside, 94), 511; *v.* Westminster (Partridge, Neville, 97), 566. The following are the positions to date:—

| | Matches. | | | | | Scores. | |
|---|---|---|---|---|---|---|---|
| | Shot. | Won. | Lost. | Drawn. | Points. | For. | Against. |
| Westminster ... | 12 | 11 | 1 | 0 | 22 | 6,844 | 6,550 |
| Shoreditch ... | 12 | 9 | 2 | 1 | 19 | 6,816 | 6,560 |
| Ilford ... | 12 | 9 | 3 | 0 | 18 | 6,758 | 6,513 |
| Central ... | 12 | 8 | 3 | 1 | 17 | 6,766 | 6,581 |
| Brompton ... | 12 | 6 | 6 | 0 | 12 | 6,712 | 6,602 |
| St. James' ... | 12 | 5 | 7 | 0 | 10 | 6,474 | 6,633 |
| Hackney ... | 12 | 3 | 9 | 0 | 4 | 6,522 | 6,556 |
| Stepney ... | 12 | 2 | 10 | 0 | 4 | 6,459 | 6,512 |
| Poplar ... | 12 | 0 | 12 | 0 | 0 | 5,865 | 6,709 |

**Multiplex Radiotelegraphy.**—Ricardo Moretti has recently patented a system of multiplex radiotelegraphy depending on selective resonance. A number of transmitters are arranged at the sending station so that variations of definite frequencies can be set up in the high-frequency current supplied to an oscillating circuit coupled directly or inductively to a single aerial. At the receiving station, there are connected in the circuit of a single wave detector, telephone receivers, each of which responds only to a tone of predetermined pitch. Transmission proceeds exactly as in wireless telephony, in that there are radiated from the antenna high-frequency oscillations which are changed in pitch by a microphone or other means. In one arrangement, Moretti uses a number (say three) of sound pipes each emitting a characteristic note when supplied with compressed air (under the control of switch keys). To permit of separation of the individual tones at the receiving station, a "monophone" is substituted for the ordinary telephone receiver. A monophone is, as its name indicates, a telephone receiver, the diaphragm of which is set in vibration only by a certain definite frequency of stimuli. Each monophone at the receiving station reproduces only the signals sent out at corresponding frequency from the transmitting station, and thus as many messages can be sent simultaneously from, and received simultaneously by, a single aerial, as there are sound pipes and monophones.

In an alternative arrangement, Moretti replaces the sound pipe by electromagnetically operated tuning forks which, under the control of the several sending keys, set up intermittent currents of definite frequencies in the windings of a single iron core which actuates the diaphragm of a microphone in the antenna circuit. This arrangement is essentially that of a telephone relay, except that a number of relay windings are employed instead of a single winding. At the receiving station, the antenna is coupled inductively to a resonant circuit containing a thermo-electric detector, across which are shunted the three monophones. The latter analyse the complex oscillations received as in the previous case. Either of the systems described above is applicable to the simultaneous reception in one station of signals emitted by a number of stations.

**Porous Accumulator Plates.**—The process recently evolved by Prof. H. T. Hannover (Rector of the Copenhagen Technical College), for the production of porous accumulator plates, is based upon the fact that the predominating metal in an alloy solidifies first, and leaves the eutectic disseminated for a time in liquid form throughout the mass. Conversely, during reheating, the eutectic melts first, and may be removed by centrifugal force or other means, thus leaving a honeycombed mass of metal of high porosity. The lead-antimony eutectic contains 13 per cent. antimony and 87 per cent. lead, so that in a 96 per cent. lead alloy,




27 per cent. of the lead will go to form the eutectic, which solidifies at about 228° C., the remainder of the lead having solidified at 322° C. The small percentage of antimony remaining in the lead matrix after expulsion of the molten eutectic is said not to affect the electrochemical capacity of the plates, but appreciably increases their strength.

After trying various other methods, Prof. Hannover concludes that the best method of expelling the eutectic is by whirling. Cakes of the alloy are mounted in suitable frames carried by the arm of a whirling machine, and the discharge side of the plate is covered by gauze backed by a grating. To prevent cracking of the surface of the plate, it is necessary to tighten up the mould clamps as the eutectic is expelled. This adjustment is effected by the linkwork shown in fig. 1, and actuated by a hand wheel on the spindle S. If the moulds be filled while in the whirling machine, with a view to expelling the eutectic during cooling, instead of after reheating, the molten metal runs through the gauze, but it should be possible to overcome this difficulty.

Tests made in the shops of the Danish State Railways on Planté plates prepared by this process show the maximum safe charge and discharge current to be increased considerably, and it is claimed that the Hannover plates are very suitable for automobile and submarine use. It is easy to prepare plates of more than 50 per cent porosity by the above means, and assuming the number of pores to average 13,000 per sq. in. (as found by microscopical examination), and to be of circular section and perpendicular to the surface of the plate, the total surface of the latter is about 130 times its natural superficial area in the case of a plate 5·5 × 3·25 × 0·25 in. Though porous metals prepared by the Hannover process have only been applied to the manufacture of accumulators as yet, it is hoped that they will prove applicable to metallic filters, self-oiling (honeycomb) bearings, catalysers, soldering sticks and various classes of ornamental work.

**Electric Lighting and Engine Starting on Motor-Cycles.**—Following the general adoption of electric lighting on motor-cars, and the later development of electrically-operated engine starters, comes the news that one of the leading American motor-cycle concerns—the Hendee Manufacturing Co.—is fitting some of its 1914 models of "Indian" motor-bicycles with a dynamo-motor which is employed for both functions. The combination machine, which has four poles and four sets of brushes, is mounted slightly in advance of the engine, to the crankshaft of which it is connected by a chain. As a generator it commences to supply current to the battery at a speed of 8 or 12 miles per hour, according to whether the high or low gear is in operation, an automatic cut-out breaking the connection between the dynamo—which is in operation the whole of the time the engine is running—and the accumulators when the latter are fully charged. The machine is fitted with both a head light and a tail lamp, thus meeting the requirements of the law as lately defined by the Divisional Courts, to the effect that a motor-cycle, as well as a motor-car, must have a rear light. We understand that one of the new motor-cycles will be on view at the Cycle and Motor-Cycle Exhibition, which opens at Olympia on the 24th inst., when doubtless it will attract attention on the part of the many motor-cyclists who are now found in the ranks of electrical engineers.

**Electrical Trades Benevolent Institution.**—We trust that during to-day and to-morrow many of our readers will be calling on the telephone to Mr. F. B. O. Hawes, the secretary of the Electrical Trades Benevolent Institution, ordering tickets for the dramatic performance which is to be given at the Court Theatre, to-morrow (Saturday) evening, by the Garrick Dramatic Society. The particulars were given fully in our issue of November 7th (page 761). At the time of writing, we are sorry to learn that the applications have been far less satisfactory than they were last year. Mr. Hawes's telephone number is "Brixton 1833," and his address is 18, Park Mansions, Vauxhall Park, South Lambeth Road, London, S.W.

**The Debenture—Its Use and Abuse.**—We have received from Mr. H. W. Jordan, company registration agent, an advance copy of a lecture to be delivered by him before a City Secretarial Association on the subject of "The Debenture—Its Use and Abuse." If the members of the Association referred to are really experienced secretaries of public companies they will certainly not be instructed; but they will, no doubt, appreciate the lighter vein of some of the matter presented. A chapter is devoted to "freak debentures," in which, among other things, the writer refers to "Church Debentures," "Chapel Debentures," and other mixtures of so-called religion and mammon. Perhaps the most important part of the pamphlet is that which notices the abuse of the debenture, and, in the course of his remarks, the writer assumes that X is an owner of an unsound business, and that things are going from bad to worse. A brilliant idea occurs to him. Why not form a company to acquire the undertaking; write up the goodwill, and sell the concern for a large sum, to be satisfied by the issue to X. or his nominees, of debentures? Then, all that remains for him to do is to go on drawing for a year or so a handsome remuneration as managing director, discharging the liabilities incurred prior to formation, incurring new ones freely, and, as soon as a creditor levies execution, to enforce his security. The Receiver appointed on his behalf by him will dispose of the assets for what they will fetch; and as the amount will probably be less than the face value of the debentures, the sum will be handed over to the holder. He can laugh at the unsecured creditors. By this means the vendor has not only avoided bankruptcy, but he has actually enriched himself at the expense of the obliging creditors, who are robbed under the cloak of the Company Act, for the goods supplied by them are sold for his benefit as the holder of the debentures. No longer has the unsuccessful trader to face the prospect of being harassed in all sorts of ways, perhaps turned out of home, spurned by acquaintances, and ultimately adjudged bankrupt—and much more, though the picture is by no means well drawn. As an alternative to pocketing the proceeds of the sale, X, the debenture-holder, may himself take over the assets in satisfaction of his "claim." If so disposed, he may forthwith form another company to acquire the assets, again taking debentures for them, and in process of time once more obtain possession of the undertaking. This procedure may be repeated *ad infinitum*, the sufferers being powerless to interfere. Mr. Jordan informs us that one individual who was adjudicated bankrupt in 1899, has, in fact, since that date performed the operation no fewer than 13 times, and apparently he is still going strong, for not long ago he registered his fourteenth company.

**Tungsten Lamp Patents.**—After protracted proceedings, extending over two or three years, the German Patent Office has decided definitely, despite the opposition of 16 firms, in favour of the fundamental patent for drawing tungsten wire for metallic-filament lamps. It will be remembered that the General Electric Co., of the United States, after experiments which were spread over a period of years, succeeded in devising the particular system whereby it was possible to draw tungsten wire of a convenient thickness, or rather thinness, for lamp filament. As a result of the existing interchange arrangements existing between the General Electric Co. and the Allgemeine Elektrizitäts Gesellschaft, of Berlin, the German patents for the new process were vested by the former in the latter, and the special agreements between the two companies permitted of the patent rights also being exercised by the Siemens & Halske Co. and the German Incandescent (Auer) Gas Light Co., whilst the Bergmann Co. was subsequently also brought within the field by the grant of a licence. As the Patent Office has now given a decision in regard to the patents, these four firms stand to benefit from the result. On the other hand, other firms have not been slow in coming forward to declare that they are not affected by the action of the Patent Office. The Julius Pintsch Co., for instance, states that the decision is of no importance in the case of Sirius lamps, which are made according to the company's own patented process, whilst Voigtlander & Lohmann point out that any firms are able to manufacture glow lamps with tungsten wire in so far as the wire is not made on the basis of the patent to which the decision refers, but is produced by any other convenient method.

**Whist Drive.**—A successful whist drive and dance in connection with the Ilkeston Corporation Tramways Benevolent Fund was held in the Town Hall, Ilkeston, on Wednesday evening, November 12th. The large ballroom was packed to its utmost capacity, between 200 and 300 ladies and gentlemen sitting at the whist tables, and nearly 200 taking part in the dancing programme. Amongst those present were:—The Mayor (Councillor J. A. Macdonald), the Town Clerk and Mrs. S. F. James, Ald. Samuel Shaw (chairman of the Tramways and Electricity Committee) and Mrs. Shaw, Mrs. L. C. F. Bellamy and Miss Leghorn, Liverpool; Councillor J. E. Bestwick and Mrs. Bestwick, Councillor and Mrs. T. Pounder, Councillor and Mrs. Starr, Councillor W. Nocn, &c. The M.C.'s for whist were Mr. L. C. F. Bellamy, manager and engineer, and conductor T. Hayday; and for dancing, motorman A. Perkins and conductor T. Wesson. The secretarial duties were carried out by the chief clerk, Mr. F. Hawley. The whist drive prizes were distributed by Mrs. Shaw. The evening was voted one of the most enjoyable and successful ever held in Ilkeston.

**Inquiries.**—Makers or English agents for "two ball" adjusters, as used in U.S.A. (in place of counterweights, and of Sicilian marble for electrical work, are asked for.

**German Enterprise in Russia.**—It is stated that the Electrical Enterprises Co., of Berlin, has entered into negotiations with a view to the erection of a generating station for supplying the western and south-western suburban districts of the city of Warsaw. Concessions have already been secured for many years from some of the local authorities concerned, whilst negotiations are pending with others and are near a conclusion. The station would have an initial capacity of from 8,000 to 10,000 H.P., and it is reported that a Russian company would be formed to undertake the management.

The Electric Lighting (1886) Co., of St. Petersburg, which has a station in course of erection at Bogorodsk, proposes to transmit a portion of the energy to Moscow for distribution from the company's existing works in that city. As the scheme has been subject to criticism in municipal circles in Moscow, the company has emphasised the fact that the power to be transmitted will only represent a small proportion in relation to that which is at present produced in the Moscow station, as by far the largest number of units will be required for Bogorodsk and vicinity. The capacity of the new station is to be 25,000 H.P. in the first place.

The Sosnowice Electricity Co., which has been constituted with a capital of £400,000, has yet to receive confirmation of its articles of association from the Government. It is expected that the projected station on completion will experience a favourable development in consequence of the scope offered by the great industrial activity in the districts of Sosnowice and Dombrova.

**The Electro-Harmonic Society.**—The concert on Monday last (Ladies' night) may fairly be classed as one of the most successful ever held by the Society. The enthusiasm of the audience was clearly manifested by the encores demanded for almost every item—sometimes double encores—and the great majority stayed until the very end, in spite of the notoriously inconvenient crush in the cloak rooms that is invariably experienced about 11 o'clock. The programme was attractive, the artistes were in good form, and the audience was in the right mood to appreciate the entertainment.

For the first time on record, the Committee put into practice the rule—hitherto a dead letter—that seats cannot be reserved for late-comers after 7.50. This was effected by sending commissionaires round to readjust the chairs—and to keep them "rectified"—and we trust this laudable practice will be maintained, to the greater comfort and convenience of the general body of the members.

**Manchester Electro-Harmonic Society.**—The second concert of this society is to take place this evening at Manchester. An excellent programme, with many intervals for social intercourse, has been arranged, the artistes being: Mr. Bridge Peters, baritone; Mr. Sydney Coltham (Westminster Abbey), tenor; Mr. Wilfrid Ludlow, entertainer; Mr. Bennett North, accompanist. For the December concert the following artistes have been engaged:—Soprano, Madame Annie Walker (London and provincial concerts); solo clarionet, Mr. Harry Mortimer; solo violoncello, Mr. Seth Lancaster; at the pianoforte, Mr. Chas. Kelly; entertainer, Mr. Foden Williams; accompanist, Mr. A. H. P. Martin.

**Fatality.**—GRIMETHORPE.—An inquest was held on November 12th, at Grimethorpe, near Barnsley, on the body of a screen boy named Fred Dunning (13), who was killed at Grimethorpe through touching a live electric wire. According to the evidence of another screen boy, the deceased had asked him if he would touch an electric wire which was placed out of reach of the boys and could only be touched by standing on the rail of a fence. This he refused to do, and Dunning said he would chance it. He, thereupon, got on to the rail and caught hold of the wire with his hand and was immediately killed. It was stated that the wire was about to be taken away owing to certain improvements in the colliery, and the jury expressed a wish to see the place in order that they could determine whether the boys were properly protected whilst at work and whether they thought there was any neglect. The inquiry was, therefore, adjourned until Tuesday last.

**London Electric Supply Companies and the Purchase Date.**—According to yesterday's *Times*, the County of London Electric Supply Co. announces that application is intended to be made on its behalf alone, or in conjunction with other London electric companies, in the ensuing Session of Parliament to bring in a Bill "for the purpose of giving the company or companies power to carry into effect agreements for the postponement of the date at which the London County Council may proceed to purchase the undertakings of the London electric companies or any of them, and for the variation of the terms and conditions under which such undertakings are purchasable, and making new provisions in regard thereto."

**Lead Poisoning.**—In the course of a lecture at the Royal Institute of Public Health, on Thursday last week, Prof. Sir Thomas Oliver described the electrolytic bath process for removing lead from the bodies of persons suffering from lead poisoning, invented by Mr. T. M. Clague, of Newcastle, to which we recently drew attention. In the case of a poisoned workman, after three or four baths, the morbid symptoms disappeared, and lead was found in the water and on the electrode, while the man's health was greatly improved. It is hoped that the treatment will be given a wide trial, and will be found successful in general application.

**An Electrically-Driven Weaving Shed at Bradford.**—Recently the Bradford Electricity Committee inspected the new weaving shed erected by Messrs. J. Emsley & Co., and electrically equipped by the electricity department. The shed contains 346 five-quarter to seven-quarter looms, arranged in seven groups, six comprising approximately 54 looms each, and the seventh about half that number, each group being driven from a separate line shaft. The looms are placed at right angles to the shafts, and are each driven by a half-turn belt. This has resulted in a reduction of about 30 per cent. in the shafting, and the power required to run it. The power to the line shafts, which run at a speed of from 185 to 200 R.P.M., is transmitted from seven 20-H.P. three-phase induction motors by means of Westinghouse chains, running in oil baths, the motors being placed approximately in the centre of the shafts. For driving the dressing frames a 15-H.P. motor is provided, also chain driven. Other motors installed include two of 5-H.P. each, driving a Gimson lift and an induced draught fan.

The shed is ventilated by 14 24-in. electrically-driven reversible fans. The installation is controlled from a switchboard situated in the basement; all the power circuits are run to a common fuse board, a meter being placed in each circuit. An oil switch, which controls the supply of current to the whole of the power circuits, can be operated in cases of emergency by means of push buttons situated in various parts of the shed. The premises are lighted by means of 741 40-watt lamps and 35 63-watt lamps, the latter of which are arranged as pilots for providing general illumination throughout the shed when the loom lights are not in use. There are also 62 5-ampere plugs at various points for the purpose of effecting temporary lighting where required. The whole of the lighting is divided into three main circuits, which in turn are split up into a number of sub-circuits each controlling not more than 12 lights.

In the piece room special attention has been given to the lighting of the menders' benches. Cooper Hewitt mercury vapour lamps (fitted with colour correcting shades) have been installed for inspecting pieces. The kitchen is equipped with an electric oven, a large hot cupboard capable of warming 50 dinners, and two electric water boilers, each holding nine gallons and capable of boiling four gallons of water in 15 minutes.

**Postal Servants.**—At an interview with a deputation representing nearly 100,000 postal employés on Wednesday, the Postmaster-General, Mr. H. Samuel, stated that the Government had decided not to enforce the recommendations of the Holt Committee in the direction of longer hours for certain classes without increase of pay. He reviewed the advantages and privileges enjoyed by postal servants, and stated that the Government agreed that the rates of pay recommended by the Committee were adequate. The increase of 15 per cent. demanded could not be granted, but the Government would authorise the immediate application of the new scales, which would benefit a very considerable proportion of the staff. The total estimated annual cost of the concessions arising out of the Holt report would be 1¼ million pounds. If a strike took place, things would not go on as before; the country would demand that measures should be taken which would render the recurrence of such an event impossible.

**Licensing Electricians on the Rand.**—The *Rand Daily Mail* says that the Johannesburg Town Council last month had before it new by-laws relating to the licensing of electricians. It is suggested that the examination required under these by-laws be carried out by the authorities of the South African School of Mines and Technology, as is at present done in the case of the plumbers, the Board of Examiners to be composed of the following:—(1) The general manager of the Council's electric supply department, or his authorised representative; (2) the Professor of Electrotechnics of the School of Mines; (3) a representative of the electrical section of the Master Builders' Association; and (4) a representative of the electricians. Both of the two latter examiners to be elected annually.

**Cadder Colliery Fire.**—The report of Sir H. Cunynghame to the Home Secretary on the cause of the fire at Cadder Colliery on August 3rd, was issued last week. It states that all the expert witnesses agreed that the fire was most probably due to lights or matches; he did not consider that electricity was the cause of the fire, and, generally speaking, the electrical installation was a good one. If an independent telephone circuit had existed along the return airway it might possibly have saved all the men.

**Wind-power Electric Plant.**—With reference to the letter on this subject in our "Correspondence" columns to-day, we may refer readers who are interested to an article in our issue of December 20th, 1912, in which we described the wind motor invented by Mr. Turnbull.

**Appointments Vacant.**—Three switchboard attendants, 8-hour shifts, for Birkenhead Corporation (30s. to 35s.). Switchboard attendant for Stoke-on-Trent Corporation (27s. 6d.). Junior switchboard attendant for Salford Corporation (26s.). See advertisement pages to-day.

**Tramcars held up by a Cat.**—A cat on Thursday held up a line of tramcars and took a free ride on a car. Near Kennington Gate the cat sat on the track: the approaching car stopped and the cat ran underneath. For a quarter of an hour the cars came on, and at last it was decided, after the flooring had been vainly taken up, that the first car must go on its way. At Blackfriars the cat was found sitting on the motor, uninjured except for a graze on the nose.—*Standard.*

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

**Central Station Officials.**—The Whitehaven T.C. has confirmed the appointment of MR. LIONEL B. HOGARTH, of Morecambe, as the borough electrical engineer.

The *Australian Mining Standard* states that MR. ALFRED SMYTH has been appointed overhead superintendent in the Melbourne electric supply department, at a salary of £286, rising to £338.

MR. VINCENT A. PASK, of the Hull electricity department, has been appointed charge engineer at the Bootle Corporation electricity works.

MR. PERCY HODGES, who has been engaged at the Blackpool Corporation electricity works, has accepted an appointment at Valparaiso. Mr. C. Furness, chief electrical engineer, on behalf of the staff at Blackpool, has handed to Mr. Hodges a gold Waltham watch, a travelling trunk, and a fountain pen.

MR. T. E. BOOTHBY is leaving the Greenhill Works of the Oldham Corporation electricity department, to take up the position of shift engineer at the works of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board.

**General.**—It is announced that MR. GEORGE BALFOUR, M.I.E.E., of Messrs. Balfour, Beatty & Co., has been elected a director of the United Electric Tramways of Monte Video, Ltd.

MR. H. V. ROWE, who has left the British Insulated and Helsby Cables, Ltd., Helsby Works, to take up an appointment at Liverpool, has been presented by the office staff at Helsby with a dressing case.

COUNCILLOR G. H. COOP, electrical engineer, has been elevated to the aldermanic bench at Ashton-under-Lyne.

The *Standard* states that the HON. ADAM BECK, chairman of the Ontario Hydro-Electric Power Commission, has rented Hilton Lodge, near Derby.

MR. J. R. DAGNALL was last week appointed chairman of the Manchester Corporation Electricity Committee, and MR. ALDERMAN WALKER, vice-chairman.

The Royal Society has awarded the Hughes Medal to DR. ALEXANDER GRAHAM BELL, on the ground of his share in the invention of the telephone, especially the construction of the telephone receiver.

A special meeting of the contributors to the Benevolent Fund of the Institution of Civil Engineers has been called for December 1st, for the purpose of appointing a trustee in place of the late Sir W. H. Preece.

The Electrical Co., Ltd., have appointed MR. G. S. HELME (late of the Lancashire Dynamo and Motor Co.) to be their engineer and sole representative in Scotland. Mr. Helme will take up his appointment immediately, his headquarters being the company's present Glasgow address, Baltic Chambers, 50, Wellington Street.

MR. M. C. SHEPHERD, who for some years has conducted the paraffin and petrol engine department of Messrs. Belliss and Morcom in London, on Thursday severed his connection with that firm.

Mr. HERBERT BROADBENT, chief electrical engineer to the Corporation of Perth, W.A., is in this country for a few weeks, on a business trip. His address is c/o Mr. Frank Broadbent, 4, Queen Street Place, E.C.

**Obituary.**—MR. THOS. SMITH.—The death took place on November 14th of Mr. Thos. Smith, for over 20 years on the staff of the Liverpool Corporation Electric Supply Department. He was 71 years of age.

**Will.**—The late MR. T. FRAME THOMSON left £52,084 gross and £47,183 net personalty.

## NEW COMPANIES REGISTERED.

**Sunturbo Engineering Co., Ltd.** (132,158).—This company was registered on November 13th, with a capital of £220,000 in £1 shares (160,000 7 per cent. cum. pref.), to acquire (1) that portion of the business carried on by the Sun Patent Evaporator Co., Ltd., at Tower Buildings, Water Street, Liverpool, as the manufacturers of Patent Sunturbo Pumps, and (2) as a going concern the business formerly carried on by Peter Pilkington, Ltd., of Bamber Bridge, Lancs., to carry on the same, and the business of engineers, founders, smiths, metal workers, electricians, manufacturers of pumps and mechanical and engineering devices and contrivances in connection with pumps and pumping machinery, &c. The subscribers (with one share each) are:—W. E. Hall, 79, Queen Street, E.C., chartered secretary; W. J. Watchurst, 103, Stradella Road, Herne Hill, S.E., master printer; G. Paine, 74, Swaffield Road, Wandsworth, S.W., clerk; A. Howarth, 79, Queen Street, E.C., engineer; H. C. Mossop, 79, Queen Street, E.C., solicitor; Winifred Briggs, 52, Pretoria Avenue, Walthamstow, E., stenographer; Gertrude Earp, 28, Overhill Road, Dulwich, S.E., stenographer. Minimum cash subscription, seven shares. The first directors are G. W. Grimshaw, Glengarry, Lytham; G. B. Atherton, Tower Buildings, Liverpool; H. W. Boultbee, Silverne, Whitby, Cheshire; A. Howarth, 79, Queen Street, E.C.; W. Norris, Bamber Bridge; F. K. Woodroffe, Cabra House, Newton La, Chester; and G. A. Child, Oaklands, Edenbridge; qualification, £200; remuneration (except managing director), £150 each per annum (chairman £200) and 5 per cent. of the net profits, after deducting 10 per cent. upon the paid up capital, and such sum as may be placed to reserve. Registered office 79, Queen Street, E.C.

**Cumberland Waste Heat Owners Co., Ltd.** (132,100).—This company was registered on November 11th, with a capital of £50,000 in shares, to carry on the business of producers and suppliers of electrical energy for public and private purposes, to acquire from public authorities and others waste heat or gas and surplus high and low-pressure steam or other fuel for generating electrical energy, &c. The subscribers (with one share each) are:—L. Wood, The Hermitage, Chester-le-Street, colliery proprietor; C. S. Hunting, 13, Milburn House, Newcastle-on-Tyne. Private company. The number of directors is not to be less than two or more than twelve, provided that every waste heat owner from whom the company obtained supplies, as aforesaid, may nominate a director, even if the number of directors is thereby increased beyond 12. The first directors are L. Wood and C. S. Hunting; qualification (except first directors or such nominees), £500; remuneration (if any) as fixed by the company. Solicitors, Ingledew & Sons, Cardiff. Registered by Kerr & Lanham, 16, Furnival Street, E.C.

**Llanidloes Electric Lighting Co., Ltd.** (132,133).—This company was registered on November 12th, with a capital of £3,000 in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—R. Roots, 7, Molesford Road, Parsons Green, S.W., clerk; A. H. Cohen, 115, Burton Road, Brixton, S.W., clerk. Private company. The first directors are not named. Solicitor, W. George, Llanidloes. Registered by Rhys Roberts & Co., 63, Queen Victoria Street, E.C.

**Somerby Electric Light Co., Ltd.** (132,091).—This company was registered on November 10th, with a capital of £1,000, in £1 shares, to carry on at Somerby, Leicestershire, and elsewhere, the business of an electric light company in all its branches. The subscribers (with one share each) are:—S. C. Hobson, Wycliffe House, Melton Mowbray, spinner; W. J. New, Melton Mowbray, solicitor; J. C. Wigham, Broad Sanctuary Chambers, Westminster, S.W., engineer. Private company. The number of directors is not to be less than three or more than six; the first are S. C. Hobson, W. J. New, J. C. Wigham, C. Glover and C. E. Hay. Registered office, 33, Regent Street, Melton Mowbray.

**Chinnerys, Ltd.** (132,163).—This company was registered on November 14th, with a capital of £2,500 in 2,350 preferred ordinary shares of £1 each, and 3 000 deferred shares of 1s. each, to carry on the business of advertising contractors and agents, sign and banner writers, manufacturers of, and dealers in, advertising signs, devices and apparatus, facias, electrical fittings and appliances, &c. The subscribers (with one preferred ordinary share each) are:—H. A. Turner, 17, Waterloo Place, Pall Mall, S.W., engineer; R. A. Blackford, 17, Waterloo Place, Pall Mall, S.W., chartered accountant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; remuneration, £25 each per annum (chairman £50). Registered office, 23, Old Street, E.C.

**Handley & Robinson, Ltd.** (4,064).—This company was registered in Dublin on November 11th, with a capital of £3,000 in £1 shares, to carry on the business of electricians, contractors, motor and general engineers, heating, lighting, &c. The subscribers (with 250 shares each) are:—A. Handley, 27, South King Street, Dublin, electrical engineer; S. T. Robinson, 27, South King Street, Dublin, electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are A. Handley and S. T. Robinson. Registered office, 27, South King Street, Dublin.

**Edison & Swan Electric Co. (India), Ltd.** (132,179).—This company was registered on November 15th, with a capital of £10,000, in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—C. J. Ford, 36, Queen Street, E.C., company director; C. E. Hunter, 36, Queen Street, E.C., company director; G. Gimingham, 36, Queen Street, E.C., company director. Private company. The number of directors is not to be less than two or more than five; the first are C. J. Ford, C. E. Hunter and E. Gimingham; qualification, £100; remuneration as fixed by the company. Registered office, 36-37, Queen Street, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Honiton and District Electric Supply Co., Ltd.**—Particulars of £2,000 debentures, created October 8th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £1,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Jandus Arc Lamp and Electric Co., Ltd.** (43,898).—Capital, £30,000 in £10 shares. Return dated August 12th (filed September 24th, 1913), 2,041 shares taken up, £5 per share called up on 1,195 and £10 per share on 250, £8,475 paid; £5,960 considered as paid on 596 shares. Mortgages and charges: £1,079 14s. 1d.

**James Keith & Blackman Co., Ltd.**—Issue on November 13th, of £100 debentures, part of a series of which particulars have already been filed.

**W. A. Stevens, Ltd.**—Trust deed dated November 11th, 1913, to secure £50,000 debenture stock, charged on freehold land and premises in St. Peter's Street, Maidstone, and company's property, including uncalled capital. Trustees: W. Wolsey, jun., Bull Yard, Peckham, S.E., and A. G. Mickleburgh, 50, Cannon Street, E.C.

**Electric Law Press, Ltd.**—Particulars of £5,000 debentures, created August 1st, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue (on October 28th) being £4,400. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Memorandum of satisfaction in full on October 28th, 1913, of debentures dated January 31st and February 10th, 1910, securing £2,500, also notified.

## CITY NOTES.

### Allgemeine Elektrizitats Gesellschaft.

THE report for the financial year ended on June 30th, 1913, which was the thirtieth in the company's history, states that the year yielded the best results hitherto attained, especially in turnover and orders, and that it proved that the industry was able to offer adequate resistance to the continual political unrest in the past 12 months. A moderate slackening of the pace would presumably not damage the working results, but would probably relieve the pressure of the production extending over two and three shifts, and, at the same time, facilitate more comprehensive improvements in the methods of manufacturing. So far, however, a decrease in the company's degree of employment is scarcely to be perceived, because the progressive electrification in Europe, particularly in Russia, as well as outside of Europe, is affording a large turnover.

In Germany the supply of current to distant districts has experienced a fresh incentive through the growing recognition that the production of power must be centralised on the site of calorific and hydraulic energy. Large units, in connection with which machine outputs of over 20,000 KW. are no longer rarities, and conductor networks up to 100,000 volts are leading to an increasing reduction in the price of power. The growth of business necessitated an extension of the financial basis, and an increase of £1,250,000 was made in the share capital, which resulted in the realisation of a premium of £1,365,000, which was added to the ordinary reserve fund, whilst debentures of £1,500,000 were issued in April, 1913. The augmentation renders it possible for the company to participate in the financing of the railway between Gesundbrunnen and Neukolln, for which a capital of £4,500,000 is required. The existing credit at the banks amounts to £3,850,000. The works proposed to be established in the Bitterfeld lignite district is to be on a very large scale. In common with friendly institutions, the company has assured itself of vast deposits of brown coal in order to be able to supply exceptionally cheap energy in the circumference of Berlin. Whether and in what form the supply of the suburbs of Berlin will come into consideration in this connection will depend upon the result of the negotiations pending between the City Council and the Berlin Electricity Works. The invoiced turnover in 1912-13 exceeded that in the previous year by £3,000,000, and in the first two months of the new financial year the volume of business invoiced was £1,150,000 greater than in the corresponding period of 1912, whilst the new orders booked show an increase of £1,500,000, excluding the contracts for the Gesundbrunnen-Neukolln Railway. The constant efforts made to improve the methods of manufacturing and secure a greater output with a relatively smaller number of workmen have been successful, as is shown by the fact that with a considerably increased turnover the number of workers was 68,711, as compared with 70,162 in the previous year, and of these 7,876 and 6,551 respectively were employed in the works at Vienna, Riga and Milan. The accounts indicate the following results for the past two years :—

| | 1912-13. | 1911-12. |
|---|---|---|
| Share capital .. .. .. .. .. | £7,750,000 | £6,500,000 |
| Gross profits .. .. .. .. .. | 1,690,000 | 1,405,000 |
| Depreciation .. .. .. .. .. | 41,000 | 85,000 |
| Net profits and balance forward .. .. | 1,445,000 | 1,219,000 |
| Reserve fund .. .. .. .. .. | 175,000 | 150,000 |
| Bonuses .. .. .. .. .. .. | 60,000 | 45,000 |
| Pension fund .. .. .. .. .. | 50,000 | 45,000 |
| Dividend .. .. .. .. .. .. | 1,085,000 | 910,000 |
| ,, per cent. .. .. .. .. | 14 | 14 |

The report proceeds to state that the deliveries of machines and transformers amounted to 122,452 of 1,973,987 KW., these contrasting with 118,205 and 1,861,344 KW. respectively in 1911-12. As new manufactures the company has undertaken the construction of high-frequency machines for a very high periodicity, and of motors for submarine boats. In the turbine department the turnover reached 559,908 KW., as compared with 489,942 KW. in 1911-12, and the largest units delivered comprised one turbo-dynamo of 20,000 K.V.A., three of 15,500 K.V.A., and four of 11,500 K.V.A. The manufacture of arc lamps experienced losses through the improvements made in very economical wire lamps, whilst good progress was made by meters and electrical clocks, especially those for the control of workmen. All the departments in the Oberspree cable works were adequately employed, and a constantly growing demand prevailed for lead cables for high pressures. The perfection of the methods of manufacturing permits of pressures of over 50,000 volts being dealt with. The progressive substitution of cables for overhead telephone wires, induced the company, in conjunction with other firms, to acquire the manufacturing rights for a relay which promises to be of importance in the extension of telephony over great distances. In the glow lamp factory, progress was made by the introduction of lamps of high candle-power, having an efficiency of only ½ watt per candle, and a useful lighting life of 800 hours, and at present lamps of from 600 to 3,000 C.P. are being made. The sale of normal lamps increased by 50 per cent., and a considerable reduction in the cost of production is due not only to this circumstance, but also to the introduction of labour-saving machinery. With the growth in the demand for wire lamps, the sale of carbon-filament lamps declined, and this source of light will soon belong to the past. The decision to dissolve the sales bureau of the United Glow Lamp Works, which had worked well for 10 years, was the result of this development. The company had to refuse the suggestions for the formation of a price convention for wire lamps as apart from the Customs conditions in relation to imports and the fact that the patent question* did not render a combination advisable, the latter would doubtless hamper the technical development of the lamp, which has by no means been concluded. Concerning the electrification of iron and steel works, it is mentioned that this particular work provided abundant activity for the firm. The contest between large gas engines and steam turbines as main producers of power necessitated constantly increasing the outputs of the generators. Generators of 6,000 H.P. and upwards for gas engine driving were continually being made. The electric motor is generally recognised as a practical source of power for driving all kinds of rolling mills, and the total output of the rolling mill drives hitherto carried out amounted to 760,000 H.P., including 23 for reversing mills. An increased turnover took place in mining by the further adoption of rotary compressors, which were partly driven by electricity and partly by steam turbines. Among the abundance of orders received for electric power stations and extensions, reference is made to the impending erection of four further turbo-dynamos aggregating 48,000 KW., and three further steam turbo-compressors, each of 7,500 KW. for the Victoria Falls and Transvaal Power Co. The business in tramways and light railways underwent satisfactory development, whilst large orders were received for the high speed railways in Hamburg and Buenos Ayres, and the equipment of a trial train for the Berlin City railway was in hand. The extension of electrical working on the London, Brighton and South Coast Railway resulted in a very important order for motor coach equipment on the single-phase system. A number of motor coaches has also been ordered for the Lauban-Konigszelt Railway, and 27 locomotives had likewise to be delivered.

* This question, as will be seen from another column, has now been decided in favour of the A.E.G.

## Western Telegraph Co., Ltd.

SIR J. WOLFE BARRY, K.C.B., presided, on November 12th, at Electra House, Finsbury Pavement, E.C., over the eightieth ordinary general meeting of this company.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 758) and accounts for the half-year ended June 30th, said he thought they would consider the result satisfactory. There was nothing of importance to which attention should be called. The message revenue for the period was less by £5,000 than that earned during the corresponding six months in 1912, when they were working at a higher tariff. They, however, carried 20 per cent. more traffic for this reduced revenue. The decreased receipts from messages were balanced by increased interest received from reserve fund investments. With regard to the expenses, those in London showed an increase of £630, spread over nearly all the items detailed under Abstract "A," and called for no remarks. The expenditure at the stations was more by £18,268—of this amount £8,000 was on account of salaries and wages due to annual promotions, an increased scale of foreign service allowance, and additional staff engaged to the number of 74, viz., 23 Europeans and 51 South Americans. It was also found necessary to increase the house allowances to the staff at various stations, principally in the River Plate. Foreign and other agencies cost more, as also did the maintenance of landlines, electrical instruments and cable tanks, repairs to buildings and renewal of furniture, stationery and printing. The only item in Abstract "B" which showed any material decrease was that of legal expenses. Under Abstract "C," which comprised the expenses attending the maintenance of cables, there was a decrease of about £4,000. The net result was that the revenue was practically the same as last year, and the expenses were more by £15,000. This was not unreasonable in view of the increased number of messages which were transmitted, and the upward tendency of expenses all over the world. They, like other enterprises, did more business at an increased cost to themselves and at lower charges to the public. After providing £16,373 for debenture stock interest, and £8,822 for income-tax, there remained a balance of £241,363; to this was added £33,817 brought forward from December 31st last, making a total of £275,180. A quarterly interim dividend amounting to £31,189 had been paid, £100,000 transferred to the general reserve fund, £10,000 to the land and buildings depreciation fund, and £45,000 to the provision on account of investment fluctuations. The directors recommended the declaration of a final dividend of 3s. per share, making, with the interim dividends, a total of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income-tax, which together would amount to £51,982, leaving a balance of £37,008 to be carried forward. Since June 30th last there had been, down to the present, a small increase in revenue. The interim meeting, held heretofore by this company in May, would be discontinued, and in future an annual meeting only held in November each year.

SIR JOHN DENISON-PENDER seconded the motion, and the report was adopted without discussion.

MR. ENNIS moved, and MR. NEWTON seconded, a hearty vote of thanks to the directors and staff, and this was carried and briefly acknowledged by the chairman.

**Continental.**—FRANCE.—La Société Franco-Belge pour l'Equipment des Tramways Electriques is the name of a new company which has lately been formed in Paris (53, Rue de Segur), with a capital of £4,000.

La Société d'Electro-Metallurgique de Dives reports a net profit of £59,390 for the last financial year. A dividend of 5 per cent. is being declared.

The balance-sheet of the Société Industrielle des Téléphones, of Paris, for the last financial year shows a profit of £66,110, as contrasted with only £62,700 in the preceding 12 months.

**Bradninch Electric Supply Co.**—Presiding at the annual meeting of this company, Dr. Muir said that they had had a successful year, with an increase in consumers and in income. The net revenue account showed a disposable balance of £85; £55 was distributed as dividend, and the balance, less income-tax, carried forward.

**Reduction of Capital.**—*The British Westinghouse Electric and Manufacturing Co., Ltd.*—A petition for the confirmation of the reduction of capital from £1,875,000 to £1,150,000 has been presented, and will be heard on November 25th.

## Amazon Telegraph Co., Ltd.

MR. GEORGE KEITH (chairman) presided on Tuesday, at 42, Old Broad Street, E.C., over the nineteenth ordinary general meeting of the above company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 797), he said it was with great regret that he had to announce the death of their secretary, Mr. Petley, on October 27th. In expressing their sympathy with the widow, they had considered it right to make a suitable grant, which he was sure would meet with the approval of the shareholders. He thought they would consider the report and accounts for the year ending June 30th last satisfactorily. Statistics showed that the Amazon rubber crop had again been larger than it was in the preceding year, and their business made excellent progress during the first six months of the year under review, but fell off considerably during the second six months. Their local rates were also twice reduced during the year. The first reduction took place on November 1st in last year, and was more than recouped by the corresponding increase of the traffic passing over their cables. The larger traffic of 1912 automatically brought about another reduction on April 1st, which, unfortunately, owing to the depressed state of business generally, in consequence of the low price of rubber, very adversely affected the year's income. Notwithstanding this reduction the traffic receipts now showed an increase for the whole year of £622. Interest on investments and the year's cash balance were £604 more, and the total revenue, including subsidies and transfer fees amounted to £105,666, or £1,222 more than last year. As regarded the working expenditure, station expenses were £1,181 higher, due partly to the increase in salaries and house allowances in consequence of the rising cost of living in Brazil, and partly to an increase in travelling, office repairs, and other items which fluctuated year by year. Ship expenses had been increased by £2,519, in consequence of the expenses of the light-draught steamer *Ramos* which went out in June last year being charged for the first time for the whole year. The cost of cable used during the year saw an increase in consequence of some 18 miles of cable having been used in relaying and extending the shallow water cable in the large lake on the south side of the river between Santarem and Parintins. The old gutta-percha cable laid in 1897 had become unworkable owing to faults caused by exposure at places where the lake became dry during the low river season. The india-rubber cable now laid was not so liable to those faults, and it had been extended westward for about another 30 miles, which removed the main cable from a dangerous portion of the river, where it had always suffered severely through landslips at the time of the yearly fall of the river. The cost of relaying and extending this cable practically accounted for the increase in the year's total working expenses, which amounted to £59,091, or £7,892 more than last year. As regarded the other charges upon the revenue, the half-yearly redemption of the debentures commenced to take effect from July last year. After placing £22,917 to debenture interest and sinking fund, £10,000 had been added to the general reserve fund, increasing it to £40,000, £2,500 had been added to the reserve fund for the renewal and maintenance of cable steamers, thereby increasing the fund to £14,500, and after meeting these charges and the working expenses, they again recommended the payment of a dividend of 4½ per cent., free of income-tax, carrying forward £5,571. As regarded the current year, their business continued to be very adversely affected by the bad state of the rubber industry, in consequence of the low prices of rubber, and their message receipts up to the present were not what they were at this time last year, but were about the same as they were the year before. This might be attributed to the falling off of official messages and the reduction of rates made during the year not being covered by a corresponding increase of ordinary traffic. The Amazon was the home of fine rubber. The tree might be transplanted, but the soil and climate which produced the quality of the rubber could not, and if the export duties were reduced in Brazil, as they ought to be, it was highly improbable that plantation rubber could compete with fine Para grown in its own climate. He thought the present moment was not unfavourable for higher rubber prices and for better business on the Amazon.

MR. E. B. ELLICE CLARK seconded the motion.

A SHAREHOLDER asked what was the nature of the investments which appeared in the accounts for the first time.

The CHAIRMAN said they were partly in the company's own debentures and partly in other securities, and they stood practically at the same price as they were bought at.

MR. BAILEY asked the chairman if there were any other industries on the Amazon besides the rubber industry.

The CHAIRMAN said there was the nut industry, and also a certain trade in cattle and wood, but these were comparatively small compared with the rubber industry, on which their company's trade really depended. Notwithstanding all that had been said, he did not think that the rubber industry of Brazil was in a worse position than the plantation industry of the East. Plantation rubber growers seemed to think that they could produce fine rubber by artificial means, but he, personally, was afraid that they would not succeed.

The motion was then carried.

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**Castner-Kellner Alkali Co., Ltd.**—The directors have declared a final dividend of 13½ per cent. for the six months ended September 30th, 1913, and they also recommend the payment out of reserve funds of a bonus of 10s. per share. This will be satisfied by the issue of fully-paid shares at par, one for every two held.

## National Electric Construction Co., Ltd.

THE report of the directors for the year ended December 31st, 1912, shows a gross profit of £13,370, and after deducting therefrom expenses of administration, debenture interest, &c., there remains a balance of £2,377, plus £4,357 brought forward, making a total of £6,734. From this there has to be deducted £1,550 for the debenture redemption fund, leaving £5,184, which the directors recommend be dealt with as follows:—Depreciation on free-wired installations, £382; rolling stock, &c., Dewsbury and Ossett Tramways, £228; furniture, fittings, plant and tools, £102; carry forward, £4,472. The directors deferred issuing their report and accounts in view of negotiations for an important contract which they expected to secure in October. This contract depends upon finance, and the finance to a great extent, upon certain negotiations with a municipality being brought to a successful conclusion. Steps are being taken by the syndicate controlling the business to complete these negotiations, but it is now unlikely that finality can be reached until the early part of the New Year.

*The Rhondda Tramways Construction Syndicate, Ltd. (in liquidation).*—The Rhondda Tramways Co., Ltd., was unable to pay its preference dividend owing to the coal strike and the strike of the company's employés referred to in last year's report, and this affected the company's revenue to the extent of about £1,200. The receipts of the Rhondda Tramways Co., Ltd., to October 30th of the current year amounted to £52,321, as compared with £39,340 for the corresponding period of last year, an increase of £12,980.

*Torquay Tramways Co., Ltd.*—The progress of this company was again very satisfactory, the traffic revenue for 1912 being £28,112, as compared with £22,635 for 1911, the dividend paid on the ordinary shares being 3 per cent., against 1½ per cent. for 1911. The receipts to November 2nd, 1913, show an increase of £3,920 over the corresponding period of last year.

*Dewsbury and Ossett Tramways.*—The profit, after providing for the sinking fund and interest payments to the local authorities, amounted to £1,167, as compared with £1,147 for 1911. The traffic receipts to November 2nd, 1913, show an increase of £552 over the corresponding period of last year.

*Mexborough and Swinton Tramways Co.*—A dividend of 2 per cent. was paid on the shares in the Construction Syndicate as against 2½ per cent. for the previous year, the decrease being due to the effect of the coal strike. The receipts, however, to November 2nd, 1913, show an increase of £1,548 over the corresponding period of 1912.

*Musselburgh and District Electric Light and Traction Co., Ltd.*—Traffic receipts to November 2nd, 1913, show an increase of £722 over the corresponding period of last year.

The boiler troubles referred to in the previous report appear to have been overcome. The local management has been reorganised, with beneficial results to the undertaking.

*Town Lighting Installations.*—At Bo'ness there was an increase in the gross profit of £135, but in the case of Carnarvon a decrease of £175. In both cases the results were adversely affected by the increased price of coal following the coal strike. The revenue from consumers at Bo'ness for the three quarters ending September, 1913, showed an increase of £764 over the corresponding period of last year.

In the case of Carnarvon the price of current for lighting purposes has been increased from September 29th, 1913.

*Folkestone, Sandgate and Hythe Tramways.*—The directors have abandoned this scheme as they found it impossible to get the local authorities to agree to a scheme which would enable the finance to arranged. The expenditure has amounted to £39,238, the disposal of which will be dealt with in the accounts for 1913.

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The sixteenth annual general meeting was held on Tuesday at the offices, 3, Laurence Pountney Hill, E.C., Mr. L. B. Schlesinger presiding.

The CHAIRMAN, in proposing the adoption of the above report, said that the directors had delayed issuing the accounts as they were hopeful of being in the position of reporting that at least one of the two important contracts they had been negotiating for had been secured for the company. Owing to certain developments one of the contracts in question could not be brought to a successful issue for at least another one or two months. In previous reports reference had been made to a large contract on the Continent, and the fact that so far it had not been secured might lead shareholders to think that the directors had been too sanguine in their expectations, but after hearing what he had to say he thought they would agree that the future prospects of the company were much more hopeful than the report and accounts disclosed. It was about four years ago that the negotiations were first started for the construction of an electric railway on the Continent, and last year he told them that it looked as if the negotiations were likely to be brought to a successful conclusion at an early date, as he was then in a position to inform them that all the local authorities interested, some 30 in number, had come into line and had signed a petition to the Government to authorise the formation of a joint board to carry out the scheme; that the Government, after numerous meetings with the representatives of the local authorities, had drafted a concession, the completion of which was to be delayed until after the holidays. There was, however, again considerable delay after the holidays, and their patience was sorely tried as they felt that the business might ultimately fall through. However, he could now inform them that the concession had been granted, a deposit had been put up by the authorities which, he understood, was forfeitable if the scheme was not carried through, and the joint board had been formed. A Royal Commission

appointed by the Government had been busy fixing the sites of the station, and the latest information which only came to hand a few days ago, was to the effect that all the sites had been fixed with the exception of the terminus at one end of the line, but whatever decision the Commission came to after considering the objections would be final. The president of the Committee came to London about a couple of months ago to discuss matters with Mr. Cownie, their managing director, and it was arranged that directly the joint board was in a position to finally settle the contract, Mr. Cownie would meet the Committee. They had had a very hard fight with numerous competitors for the business during the early days, but the scheme which the Committee had ultimately adopted was their scheme, and negotiations had since only been carried out with the company. He could only give them the facts and leave them to form their own conclusions. The contract, if secured, should be profitable to the company, but what was, perhaps, still more important, it would strengthen the company's position in dealing with other contracts of a similar nature. He also referred at the last meeting to another business in which they were interested, which, if brought to a successful conclusion, would result in a contract to the company running into well over £300,000. From information at their disposal they thought it probable that the financial arrangements on which that contract depended would be completed last October, but, unfortunately, their expectations were not realised, the finance having to be postponed until negotiations concerning certain widenings could be taken in hand and completed. Originally a syndicate of some £15,000 was formed by Mr. Cownie to deal with that business, and the capital was fully subscribed. The capital of the syndicate was being increased by another £30,000, for the purpose of carrying the business a step further. He was glad to say that negotiations to secure that capital were well advanced. He need hardly say that the negotiations in connection with the two contracts he had referred to had involved an enormous amount of work on the part of their managing director and their chief engineer, which was not apparent in the present report; and if they were brought to a successful conclusion, he thought that, notwithstanding any criticism on the present accounts, within a year or two the position would be very different and the company would be able to have a clean balance-sheet and a profit and loss account satisfactory to all. He might add that, in connection with any contracts, the company was financially strong enough to carry them through. Proceeding to deal with the various undertakings in which the company was interested, the chairman said he was glad to be able to say that they were making substantial progress in the right direction, and that in consequence their interest in those companies was always appreciating in value. In the Rhondda Tramways Construction Syndicate (in liquidation) they had just over £50,000, of which they had received back from the liquidators in cash approximately 70 per cent., leaving the cost of their investment at about £15,000. In respect of that interest, they were entitled, on the distribution of the securities, to receive approximately £20,000 in 6 per cent. preference shares and £9,000 in ordinary shares, all fully paid. As far as they could tell at present, the profit earned by the company this year should be sufficient to pay 6 per cent. on the preference, and at least 5 per cent. on the ordinary shares, after making the necessary reserves. Last year, however, the preference dividend had to be passed, and this year's profits would have to meet that charge. There had been a large increase in the traffic receipts, and, compared with last year, the receipts every week were showing an increase of from £100 to £150, and there was no reason why that increase should not be maintained. In the last session of Parliament the company obtained powers to run a railless traction system in connection with the tramways, which should be in operation by the middle of next year, and they had every reason to believe that with a comparatively small capital expenditure both the receipts and the profit would benefit considerably. They had £20,000 in the Torquay Tramways Co., and on the distribution of the securities they were entitled to £8,000 in 5 per cent. debentures and £16,000 in fully-paid ordinary shares. In front of those debentures were £60,000 5 per cent. prior lien debentures. It looked as if the company would this year earn a profit of not less than £15,000, compared with about £11,800 in 1912. Last year 3 per cent. was paid on the ordinary shares, as against 1½ per cent. for 1911, and he thought he might safely say that this year the dividend would again be increased. The Dewsbury and Ossett tramways continued to show satisfactory progress, the profit to date being £300 in excess of the corresponding period in 1912. The increase in the traffic receipts of the Mexborough and Swinton Tramways Co., in which they were interested, was satisfactory, and he was glad to say that the company, despite great opposition, had secured powers to construct a railless traction system to connect with Conisborough, and it was expected that the work would be put in hand within the next month or two. He was advised that the profit from the line would be substantial. Although the company had as yet only been able to pay dividends of from 2 to 2½ per cent. much better results were anticipated when the shares were taken up. In the case of the Musselburgh and District Electric Light and Traction Co., extensive track renewals had been taken in hand which would tend to reduce maintenance charges in the future. Active efforts were being made by the management to increase the lighting and power consumers, which were meeting with considerable success, and therefore they looked forward with considerable hope for the future. Dealing with the Bo'ness and Carnarvon undertakings, the Chairman said that in Bo'ness the business was showing a considerable improvement, and everything pointed to the improvement being continued. At Carnarvon to meet the increased working costs the price of current had been raised from 5d. to 6d. per unit, and that should result in a considerable increase in the revenue. The scheme for the construction of the Folkestone, Sandgate and Hythe Tramways had had to be abandoned after every effort had been made to get the local authorities concerned to agree to a workable scheme, without success. There was no doubt that if the scheme could have been carried out on the overhead system it would have been a very valuable one, but the Folkestone Corporation required the conduit system throughout, and Sandgate also stood out for that system. The Hythe Corporation was reasonable, and was prepared to agree to the overhead system, but the opposition of Folkestone was too strong. Their loss in the matter—£39,238—was a big one, but they hoped they would be able to clear it out of the account. They were just starting the construction of the Wisbech electric lighting works, and with the experience they had gained with their other undertakings it should turn out a successful venture.

Mr. J. Carr Saunders seconded the motion, which, after a few comments by shareholders, was adopted.

## West India and Panama Telegraph Co., Ltd.

Mr. W. B. Kingsford (chairman) presided on November 12th, at Winchester House, E.C., over the meeting of this company.

In moving the adoption of the report (see Elec. Rev., page 797), the Chairman said that, before proceeding to the business, he had to express the regret of the board at the death of their esteemed and venerable colleague, Mr. T. Holmes, in his 95th year, who had been a director for nearly 40 years. Mr. Holmes hardly ever missed a board meeting, and was present at one the day before he was taken ill. He was a shipowner, and was very useful to the company, especially in regard to their repairing vessels. Since the report was issued Mr. H. W. Berks had been invited to join the board, and had done so. The net result of the company's working during the half-year varied very little from that of June of last year. The total revenue amounted to £45,524, which was £1,193 less than during the corresponding period. As against this, the expenses of the half-year were £850 less, and practically the whole of that reduction arose in connection with the cost of maintaining their cables. As he had reminded them at previous meetings, their outlay under Abstract C was always subject to fluctuations. Obviously so much depended upon the time the ship was occupied and the length of cable used in repairs and renewals. Fortunately, in both respects, this time their expenditure had been a little less than usual. After placing £2,000 to reserve, they had approximately the same amount of available balance at their disposal as they had a year ago. Accordingly, they recommended the payment of the dividend proposed in the report (1s. 6d. per share on the ordinary shares), together amounting to £18,394, carrying forward £3,185 to the account of the current half-year. In the report it was mentioned that the Imperial and Canadian Governments, having brought pressure to bear on the company for a general reduction of West India rates, the directors had found it necessary to consent to this in return for subsidies on certain conditions. The deed necessary to give effect to the agreement had yet to be considered and executed, and after execution it would not become valid until it had been submitted to and approved by Parliament. He was sure that in this stage of the negotiations they would understand that that day they hardly felt at liberty to enter at all fully into a discussion on the matter. Much of what might be said about the position and prospects of the company under changed conditions would be in the nature of guesswork, and possibly, therefore, might prove to be erroneous and misleading. For example, should the agreement be carried into effect they feared that at first the earnings of the company might suffer a considerable diminution. On the other hand, they hoped that as time went on the large reduction in the rates might gradually bring about an increase of business sufficient to recoup them, and possibly do more than recoup them for their loss at the beginning. But the fear and the hope were both based not on certainty but on mere conjecture. It should be borne in mind, however, and he ventured to say this was a point which hardly admitted of doubt, that the granting of new subsidies of £16,000 a year, half to be paid by the Imperial Government and half by the Canadian Government, guaranteed for a term of 10 years, coupled with a continuance of their existing subsidies of £10,300, also guaranteed for 10 years, would give the company that important element of stability which hitherto it had not possessed. In West Indian commercial circles it was anticipated that the new tariff recently adopted by the United States would be beneficial to the Colonies. It would at once reduce duties on sugar and other products, and in three years would entirely abolish them, and thus in all probability lead to the increased consumption of these commodities. The preferential arrangements between Canada and the West Indies should also tend to improve the trade of the West Indian Colonies. The traffic receipts for the current half-year down to October 31st showed a small decrease of £508.

Mr. G. Von Chauvin seconded the motion.

Mr. Newton referred to the death of Mr. Holmes, and in regard to the negotiations as to the new rates expressed the hope that the West Indian Government would treat them generously. He pointed out that the experience of the Eastern and the Eastern Extension Telegraph Co. was that each reduction of rates was followed by a large increase in the number of messages.

The report was adopted.

**Dorman, Long & Co., Ltd.**—A final dividend of 6 per cent. is recommended, making 8½ per cent. for year.

**Rushden and District Electric Supply Co.**—The first report presented at the annual meeting yesterday, states that immediately the necessary capital was subscribed, steps were taken for the construction of the generating station on the site in Shirley Road, Rushden, and for laying down mains in Rushden and Higham Ferrers. The works include an engine room containing two Diesel oil engines of 240 H.P. each, and auxiliary machinery, battery room, water cooling tower, workshops and offices. The buildings are of solid construction and up-to-date design. The engine room affords a space for a third engine when required, and the capacity of the battery can be doubled without increasing the size of the building. The proximity of the railway enables the oil fuel to be pumped direct from the railway tank wagons into storage tanks. Mains had been laid 2 miles 1,040 yards in length, with full provision for feeder cables, regard being made to a large probable demand within a few years. There was considerable delay in the delivery of some of the machinery, but the public supply was commenced on October 15th. There are about 20 consumers, and the demand is chiefly for power purposes at present.

**Fraser & Chalmers, Ltd.**—The directors' report for the year ended June 30th (as abstracted in the *Financial News*) shows a net profit of £4,604 (after payment of debenture interest and making the usual provision for depreciation) plus £75,446 brought forward, making £80,050. The directors have paid the full preference dividend for the year of £4,725, and have transferred £60,000 to general reserve account, leaving £15,325 to be carried forward. The directors, in transferring to a reserve account so large a proportion of the balance heretofore carried in profit and loss account, have been guided by the consideration that the requirements of the business necessitated the permanent investment of more capital. The decrease in profits has been due to a continued falling off in the South African business. In England an increased trade has been done, but special expenses have been incurred owing to the changes in character of machinery sold. The directors do not recommend any dividend on the ordinary shares.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Buenos Ayres Lacroze Tramways Co.—Scrip, fully and partly paid, for a further issue of £500,000 5 per cent. consolidated mortgage debentures.

And to allow the following securities to be quoted in the Official List :—

Auckland Electric Tramways Co., Ltd.—350,000 ordinary shares of £1 each fully paid.

Urban Electric Supply Co., Ltd.—Further issue of £131,840 4½ per cent. first mortgage debenture stock.

**Norwegian Hydro-Electrical Nitrogen Co.**—This company has invited the public to subscribe 83,333 ordinary shares of £10 each at a price of 13 per cent. above par, of which 3 per cent. is the approximate dividend earned since July 1st, 1913, from which date the new issue will be entitled to dividends. The actual price is thus 110 per cent. The issue has been opened for subscription at the company's head offices at Christiania, at Stockholm, in Paris and at Geneva.

**Argentina.**—The annual general meeting of shareholders of the Compania Anglo-Argentina de Electricidad was held on the 15th ult. Profits for the year amounted to $787,772, plus $32,388 from the previous year. After placing $189,855 to amortisation account, $100,000 to reserve, $47,833 to directors, a dividend of 9 per cent. is declared (8 per cent. last year), and $44,550 carried forward.—*Review of the River Plate.*

**Boulton & Paul, Ltd.**—For the year ended September 30th, a dividend of 15 per cent. on the ordinary shares is recommended, £23,283 being carried forward.

**Provincial Tramways Co.**—The directors recommend a final dividend of 1s. per share on the ordinary £1 shares, making a total dividend of 1s. 8d. per share, or 8⅓ per cent. per annum for the year ended September 30th.

**West Kootenay Power and Light Co.**—The directors have declared a quarterly dividend of 1¼ per cent., increasing the rate from 4 to 5 per cent. per annum.

## STOCKS AND SHARES.

Tuesday Evening.

The swing of the pendulum has brought better news from Mexico, and notwithstanding the fact that money remains very dear, Stock Exchange markets responded smartly to the more cheerful conditions. It cannot be pretended, however, that any settled state has been arrived at, because, only last Monday morning, prices underwent a quick reaction upon unfavourable rumours from the theatre of disturbance. On the whole, though, markets are in a more healthy frame of mind, and one of the principal features of the moment is a robust recovery amongst Home Railway stocks.

The latter is due to the consideration, so often urged, that many stocks now look cheap, in view of the dividend accumulations which they carry in respect of the current half-year. The violent speeches of Mr. Larkin were read gloomily by the Railway market at first, but during the last day or two these utterances have been disregarded, on the assumption that the English railwaymen were not likely to come out at the call of the Irish leader. On the week, prices have improved quite materially in some cases. Amongst the exceptions must be noted East London Ordinary stock, which has dropped back to 6.

Metropolitans and Districts have followed the course of the steam companies' stocks. After being depressed, they both hardened, and at 40¼ and 28¾ respectively they show respectable rises on the week. A little attention is being attracted to the stocks of the London Electric Railway Company; the 4 per cent. Debenture stock, standing at 92, with a dividend due on January 1st, yields nearly 4½ per cent. on the money, while the company's 4 per cent. Preference can be bought at 72, and making allowance for the dividend payment on February 1st next, the return is the handsome one of 5⅝ per cent. on the money.

English Electricity Supply shares are firm, with small rises in Charing Cross, City Preference shares of both classes, Westminster Preference and City of London Ordinary. The last-named have risen to 16½, and there are bullish rumours being circulated as to the next dividend which the company is likely to declare—which rumours it may perhaps be well to accept with discretion until they are confirmed. County of London Second Debenture stock improved to nearly par, and a rise of 2 points in Kent Electric Debenture carried the price to 79. St. James's Ordinary eased off to 8⅞, South Londons to 2¹⁵/₁₆. North Metropolitan Electric Power 6 per cent. Preference has been granted quotation in the Stock Exchange Daily List, and the price is 106 to 108.

The Electric Supply Corporation has convened a meeting of debenture stock-holders for Friday in this week, with a view to enabling the Debenture stock already issued to be converted into bearer stock, should the proprietors desire. We have heard that just lately a fair block of the stock has been taken for French investors, who, of course, have a prejudice against anything that is registered. The company has £16,586 Debenture stock left as the balance of the £157,500 authorised by the Trust Deed; and the directors point out that if the security can be converted into a bearer bond, it will much facilitate the placing from time to time, as needed, of the unissued stock, and will, of course, very much increase its negotiability.

Part of the present slump in the Mexican group has been recovered, there being substantial rallies in the issue of the Mexican Light and Power Company, the Monterey Debentures, and Mexico Trams. The rises range from 2 points to 7, but, of course, they do not by any means wipe out the effects of the previous depression. The news remains of a somewhat mottled character, and during the uncertainty it is only to be expected that prices will go up and down with a considerable amount of irregularity. One of the rumours on Monday said that the rebels—whose identity, by the way, seems to be a matter of general inquisitiveness—were within 80 miles of Vera Cruz, thanks to which report the 5 per cent. Debenture stock of the Vera Cruz Company receded a trifle to 90. That there are a few buyers about is evidenced by the improvement in prices, though to this it must be added that part of the recovery consisted merely of marking up quotations that had been put down earlier, with little stock changing hands in either case.

Brazil Tractions rose 2½. Manaos Trams Debenture, however, lost 2 points at 86; considering that the stock was scarcely saleable before, the dropping of the price made little actual difference in the market. Para Electric Railways have risen substantially; this week the price shot up to 6, showing a gain of 7s. 6d. on balance. United Electric Tramways of Monte Video Preference are ⅛ down, and Calcuttas are rather easier. British Columbia Electric stocks remain a dull market; the 4½ per cent. Debenture, however, is being absorbed by investors attracted by the excellence of the security, and the price picked up a couple of points.

In the Telegraph market, the Anglo-American Telegraph trio is slightly better, although the only quotable change is a rise of ¼ in the Deferred stock. Indo-Europeans rose 10s., Westerns gained 2s. 6d., and Submarine Cable Trust certificates hardened. Direct United States Cable shares are lower, and the fall in Reuters shares made further progress, the price having now got back to 9 middle. Marconis recovered some of their volatile character. From 3¼, the price rose to 3½, but suffered a little reaction, which left them ⅜ better on the week, the 7 per cent. Participating Preference shares following in the train of the Ordinary. Canadians are steadier at 8s. 6d., while Americans cling closely to the neighbourhood of 17s. 6d.

The most interesting feature in the manufacturing market is the declaration of a dividend of 22½ per cent. by the Castner-Kellner Company, being an increase of 2½ per cent. as compared with this time last year. In addition, shareholders are given a bonus, which is equal to practically 50 per cent. in the shape of one new share, through capitalisation of reserves, and on the strength of this the price improved to 3¼⅜. That there should have been so comparatively small a gain as 1/16 may be due to the fact that the price has been creeping up steadily for some time past. The profits, curiously enough, are a little lower than they were a year ago. Edison & Swan fully-paid shares, after their 10s. fall last week, have recovered 7s. 6d., and there has been an improvement of 10s. in Henleys, taking the price to 13⅛. British Westinghouse Preference hardened a trifle. Willans & Robinson Preference has again risen 4 points. Rubber shares blossomed out into considerable strength, on account of a rise in the price of the product to 2s. 6d. per lb. This provided a ready whip for the chastisement of the "shorts" who have of late found the market so profitable a bear-garden, and whose efforts to get level have resulted in a material rise in most of the leading shares.

# SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

| NAME. | Stock or Share. | Dividends for | | Closing Quotations Nov. 18th. | Rise + or Fall — | Present Yield p.c. |
|---|---|---|---|---|---|---|
| | * | 1912. | 1913. | | | £ s. d. |
| Bournemouth & Poole, Ord. | 10 | 6 | 5† | 9⅛ — 10⅛ | .. | 5 17 1 |
| Do. 4½ % Pref. | 10 | 4½ | 4½ | 8¾ — 9¼ | .. | 4 14 9 |
| Do. Second 6 % Pref. | 10 | 6 | 6 | 10 — 10⅜ | .. | 5 14 3 |
| Do. 4½ % Deb. Stock | Stock | 4½ | 4½ | 95 — 98 | .. | 4 11 10 |
| Brompton & Kensington, Ord. | 5 | 10 | 9† | 8⅜ — 9 | .. | 5 11 1 |
| Do. 7 % Cum. Pref. | 5 | 7 | 7 | 8⅝ — 8⅞ | .. | 4 1 2 |
| Central Electric Supply, 4 % Guar. Deb. | 100 | 4 | 4 | 93 — 96 | .. | 4 3 4 |
| Charing Cross, West End & City | 5 | 5 | 5† | 4⅛ — 5 | .. | 5 0 0 |
| Do. 4½ % Cum. Pref. | 5 | 4½ | 4½ | 4 — 4½ | + ⅛ | 5 0 0 |
| Do. "City Undertaking" 4½ % Cum. Pref. | 5 | 4½ | 4½ | 3⅝ — 4⅛ | + ⅛ | 5 9 1 |
| Do. Do. 4 % Deb. | 100 | 4 | 4 | 90 — 92 | .. | 4 7 0 |
| Chelsea, Ord. | 5 | 5 | 4† | 4¼ — 5 | .. | 5 0 0 |
| Do. 4½ % Deb. | Stock | 4½ | 4½ | 94 — 97 | .. | 4 12 9 |
| City of London, Ord. | 10 | 9 | 6† | 16 — 17 | + ½ | 5 6 0 |
| Do. 6 % Cum. Pref. | 10 | 6 | 6 | 12½ — 13⅜ | .. | 4 8 11 |
| Do. 5 % Deb. | Stock | 5 | 5 | 116 —120 | .. | 4 3 4 |
| Do. 4½ % Second Deb. | 100 | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| County of London, Ord. | 10 | 6 | 5† | 11⅛ — 12 | .. | 5 0 0 |
| Do. 6 % Pref. | 10 | 6 | 6 | 11⅛ — 12 | .. | 5 0 0 |
| Do. 4½ % Deb. | Stock | 4½ | 4½ | 102½—104½ | .. | 4 6 2 |
| Do. 4½ % Second Deb. | Stock | 4½ | 4½ | 97 — 100 | +1 | 4 10 0 |
| Edmundson's, Ord. | £3 | .. | .. | ⅜ — ⅝ | .. | Nil |
| Do. 6 % Cum. Pref. | 5 | 6 | 6 | 4 — 4¼ | .. | 3 8 7 |
| Do. 6 % Non-Cum. Pref. | 5 | .. | .. | 1⅛ — 1⅝ | .. | .. |
| Do. 4½ % First Mort. Deb. | 100 | 4½ | 4½ | 80 — 88 | .. | 5 8 5 |
| Folkestone | 5 | 6 | 6 | 4¾ — 4⅞ | .. | 6 3 1 |
| Do. 5 % Cum. Pref. | 5 | 5 | 5 | 4⅜ — 4⅝ | .. | 5 2 7 |
| Do. 4½ % First Deb. | 100 | 4½ | 4½ | 89 — 91 | .. | 4 19 0 |
| Hove | 5 | 9 | 8† | 7⅞ — 8⅛ | .. | 5 10 9 |
| Kensington & Knightsbridge, Ord. | 5 | 8 | 8† | 7⅛ — 8 | .. | 5 0 0 |
| Do. 4 % Deb. | Stock | 4 | 4 | 88 — 91 | .. | 4 7 11 |
| Kent Elec. Power, 4½ % Deb. | Stock | 4½ | 4½ | 76 — 80 | +2 | 5 12 6 |
| London Electric, Ord. | 3 | 2½ | .. | 1⅛ — 1⅜ | .. | 4 12 7 |
| Do. 6 % Pref. | 5 | 6 | 6 | 4¾ — 5⅛ | .. | 5 17 1 |
| Do. 4 % First Mort. Deb. | Stock | 4 | 4 | 89 — 92 | .. | 4 7 0 |
| Metropolitan | 5 | 4 | 4† | 3⅜ — 3⅝ | .. | 5 10 4 |
| Do. 4½ % Cum. Pref. | 5 | 4½ | 4½ | 4⅛ — 4⅜ | .. | 4 17 4 |
| Do. 4½ % First Mort. Deb. | Stock | 4½ | 4½ | 96 — 99 | .. | 4 10 1 |
| Do. 3½ % Mort Deb. | Stock | 3½ | 3½ | 79 — 82 | .. | 4 5 4 |
| North Metropolitan Power Supply, 5 % Mortgages (Red.) | 100 | 5 | 5 | 99 — 102 | .. | 4 18 0 |
| Notting Hill, 6 % Non-Cum. Pref. | 10 | 6 | 6 | 10 — 10⅜ | .. | 5 11 7 |
| Oxford | 5 | 7 | 6† | 6 — 6⅜ | .. | 5 7 8 |
| St. James' and Pall Mall, Ord. | 5 | 10 | 10† | 8⅝ — 9⅛ | — ⅛ | 5 8 1 |
| Do. 7 % Pref. | 5 | 7 | 7 | 6⅜ — 7 | .. | 5 0 0 |
| Do. 3½ % Deb. | 100 | 3½ | 3½ | 82½ — 85½ | .. | 4 1 10 |
| South London, Ord. | 4 | 5a | .. | 2⅝ — 3 | — ⅛ | 7 6 8 |
| Do. 5 % First Mort. Deb. | 100 | 5 | 5 | 96 — 99 | .. | 5 1 0 |
| South Metropolitan, 7 % Pref. | 1 | 7 | 7 | 1⅞ — 1⅞ | .. | 6 1 3 |
| Do. 4½ % First Deb. Stock | 100 | 4½ | 4½ | 93 — 96 | .. | 4 13 9 |
| Urban, Ord. | £3 | Nil | .. | 5/16 — 7/16 | .. | .. |
| Do. 5 % Cum Pref. | 5 | 3 | .. | 2⅜ — 2⅝ | .. | .. |
| Do. 4½ % First Mort. Deb. | 100 | 4½ | 4½ | 83 — 86 | .. | 5 4 8 |
| Westminster, Ord. | 5 | 10 | 10† | 8⅛ — 8⅜ | .. | 5 14 3 |
| Do. 4½ % Cum Pref. | 5 | 4½ | 4½ | 4⅛ — 5⅛ | + ⅛ | 4 7 10 |

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

| | | | | | | |
|---|---|---|---|---|---|---|
| Adelaide, 6 % Pref. | 5 | 6 | 6† | 4⅞ — 5⅛ | .. | 5 17 1 |
| Calcutta, Ord. | 5 | 6½ | 5† | 7⅛ — 7⅜ xd | .. | 5 11 6 |
| Do. 5 % Pref. | 5 | 5 | 5 | 5 — 5¼ | .. | 4 15 3 |
| Calgary Power, 1st Mort. Bds. | 100 | 5 | 5 | 91 — 93 | .. | 5 7 6 |
| Canadian Gen. El. Com. | $100 | 7 | 7† | 106 —110 | +1 | 6 7 3 |
| Do. 7 % Pref. | $100 | 7 | 7 | 117 —122 | .. | 5 14 9 |
| Cordoba Lt., Power and T., Ord. | 1 | 5 | .. | 1/16 — 1/8 | .. | 6 3 1 |
| Do. 5 % Deb. | 100 | 5 | 5 | 91 — 93 | .. | 5 7 6 |
| Elec. Lt. and P. of Cochabamba, 6 % Bonds | 100 | 6 | 6 | 90½ — 92½ | .. | 6 9 9 |
| Elec. Supply Victoria, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 87½ — 90½ | .. | 5 10 6 |
| Elec. Dev. Ontario, 5 % 1st Mort. Bonds | $500 | 5 | 5 | 93½ — 95½ | + ½ | 5 4 9 |
| Kalgoorlie Elec. P. and L., Ord. | 10/- | Nil | .. | 3/16 — 5/16 | .. | Nil |
| Do. 6 % Pref. | 1 | 6 | 6† | 13/16 — 7/8 | .. | 11 5 8 |
| Kaministiquia Power, 5 % G. Bs. | $500 | 5 | 5 | 102½ —104½ | .. | 4 15 8 |
| Madras, Ord. | 5 | Nil | .. | 1/2 — 1/2 | .. | .. |
| Melbourne, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 103 —106 | .. | 4 14 4 |
| Mexican El. Lt., 5 % 1st M. Bds. | .. | 5 | 5 | 66 — 71 | +1 | 7 0 10 |
| Mexican Lt. & Power, Common | $100 | 4 | 4 | 50 — 54 | +4½ | 7 8 2 |
| Do. 7 % Cum. Pref. | $100 | 7 | 7 | 78 — 83 | +3 | 8 9 8 |
| Do. 5 % 1st Mort. Gold Bds. | .. | 5 | 5 | 78 — 83 | +7 | 6 0 6 |
| Do. 5 % 2nd Mort. Bonds | 100 | 5 | 5 | 68 — 73 | +3 | 6 17 0 |
| Monterey Rly., Light & Power, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 55 — 62 | +4½ | 8 1 4 |
| Montreal, Lt., H. and Power | $100 | 9 | 10† | 212 - 218 | +2 | 4 11 9 |
| Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds | $500 | 5a | £a | 15 — 25 | .. | .. |
| River Plate, Ord. | Stock | 10 | .. | 207 —217 | .. | 4 8 0 |
| Do. 6 % Non-Cum. Pref. | Do. | 6 | 6 | 99 —104 | .. | 5 15 5 |
| Do. 5 % Deb. Stock | Do. | 5 | 5 | 97½ — 99½ | .. | 4 19 6 |
| Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb. | 100 | 4½ | 4½ | 99 —101 | .. | 4 9 4 |
| Shawinigan Water, Capital | $100 | 5½ | 6† | 131 —136 | .. | 4 8 3 |
| Do. 5 % Con. 1st Mort. Bonds | $500 | 5 | 5 | 105 —107 | .. | 4 13 6 |
| Do. 4½ % Per. Deb. | Stock | 4½ | 4½ | 98 —100 xd | .. | 4 10 |
| Toronto Power, 4½ % Deb. | Do. | 4½ | 4½ | 97 —100 | .. | 4 10 0 |
| Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb. | 100 | 5 | 5 | 89 - 91 | — ⅛ | 5 8 9 |
| Victoria Falls Power, Pref. | 1 | 6 | 6 | 7/8 - 15/16 | + 1/32 | 6 8 0 |
| West Kootenay Power and Lt., 1st Mort. 6 % Gold | 100 | 6 | 6 | 103 —105 | .. | 5 14 3 |

## TELEGRAPH AND TELEPHONE COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Amazon Telegraph | 10 | 4½ | .. | 6⅞ — 7⅛ | .. | 6 2 0 |
| Do. 5 % Deb. Red. | Stock | 5 | 5 | 95 — 97 | .. | 5 3 1 |
| American Telep. & Teleg., Cap. | $100 | 8 | 8 | 123 —125 | .. | 6 8 0 |
| Do. Collat. Trust | $1000 | 4 | 4 | 89 — 92 | .. | 4 7 0 |
| Anglo-American Telegraph | Stock | 3 | 3 | 62 — 65 | .. | 4 12 4 |
| Do. 6 % Pref. | Do. | 6 | 6 | 104½—105½ | .. | 5 13 9 |
| Do. Def. | 30/- | .. | .. | 23½ — 24 | + ½ | 6 5 0 |
| Anglo - Portuguese Tel., 5 % Mort. Deb. | 100 | 5 | 5 | 102 —104 | .. | 4 16 2 |
| Chili Telephone | 5 | 8 | .. | 7/16 — 7/8 | .. | 5 5 7 |
| Commercial Cable, Stlg. 4 % Deb. | Stock | 4 | 4 | 79 — 81 | .. | 4 18 9 |
| Cuba Telegraph | 10 | 6 | 6† | 8¾ — 9¼ | .. | 6 9 9 |
| Do. 10 % Pref. | 10 | 10 | 10 | 14½ — 15½ | .. | 6 11 2 |
| Direct Spanish Telegraph, Ord. | 5 | 4 | 4 | 8¼ — 8½ | .. | 5 0 8 |
| Do. 10 % Cum. Pref. | 5 | 10 | .. | 6¾ — 7¼ | .. | 6 12 0 |
| Direct United States Cable | 10 | 4 | 4† | 6½ — 6¾ | — ⅛ | 5 18 6 |
| Direct W. India Cable, 4½ % Reg. Deb. | 100 | 4½ | 4½ | 98 —100 | .. | 4 10 0 |
| Eastern Telegraph, Ord. Stock | Stock | 7 | 7 | 126 —129 | .. | 5 8 6 |
| Do. 3½ % Pref. Stock | Do. | 3½ | 3½ | 75— 77 | .. | 4 10 11 |
| Do. 4 % Mort. Deb. | Do. | 4 | 4 | 95 — 97 xd | .. | 4 2 6 |
| Eastern Extension | 10 | 7 | 7 | 12¼ — 12⅝ | .. | 5 9 10 |
| Do. 4 % Deb. | Stock | 4 | 4 | 94 — 96 | .. | 4 3 4 |
| Globe Telegraph and Trust | 10 | 6 | 6† | 10⅞ — 11¼ | .. | 5 6 8 |
| Do. 6 % Pref. | 10 | 6 | 6 | 11⅞ — 12⅜ | .. | 4 17 0 |
| Great Northern Telegraph | 10 | 20 | 5† | 30½ — 32½ | .. | 6 2 8 |
| Indo-European Telegraph | 25 | 13 | 5† | 57 — 59 | + ½ | 5 10 2 |
| Mackay Companies Common | $100 | 5 | 5 | 82 — 86 | .. | 5 17 8 |
| Do. 4 % Cum. Pref. | $100 | 4 | 4 | 67 — 70 | .. | 5 14 4 |
| Marconi's Wireless Telegraph | 1 | 20 | .. | 3⅜ — 3½ | + 1/16 | 5 14 3 |
| Do. 7 % Cum. Partic. Pref. | 1 | 17 | .. | 2 1/16 — 2 1/8 | + 1/16 | 6 0 9 |
| Monte Video Telephone, Ord. | 1 | 6 | 6 | ¾ — 1 | .. | 6 0 0 |
| Do. 5 % Pref. | 1 | 5 | 5 | 1/2 — 11/16 | .. | 6 3 1 |
| New York Telep., 4½ % Gen. Bnds. | 100 | 4½ | 4½ | 96⅜ — 97⅜ | .. | 4 12 1 |
| Oriental Telep. and Elec. | 1 | 10 | 10† | 1¾ — 2 | .. | 5 0 0 |
| Do. 6 % Cum. Pref. | 1 | 6 | 6 | 1 1/16 — 1 1/8 | .. | 5 1 1 |
| Do. 4 % Red. Deb. | Stock | 4 | 4 | 86 — 88 | .. | 4 10 11 |
| Pacific and European Tel., 4 % Guar. Debs. | Do. | 4 | 4 | 97 — 99 | + ½ | 4 1 0 |
| Reuter's | 10 | 10 | 10† | 8½ — 9½ | — ½ | 10 10 6 |
| Submarine Cables Trust | Cert. | 6 | 6 | 122½—125½ | + ½ | 4 15 7 |
| Telephone Co. of Egypt, 4½ % Deb. Red. | Stock | 4½ | 4½ | 95 — 97 | .. | 4 12 11 |
| United River Plate Telephone | 5 | 8 | 6† | 6¼ — 6⅝ | .. | 5 1 6 |
| Do. 5 % Cum. Pref. | 5 | 5 | 5 | 5 — 5½ | .. | 4 11 0 |
| West Coast of America | 2½ | 2½ | .. | 1 1/16 — 1 1/8 | .. | 4 3 4 |
| Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel. | 100 | 4 | 4 | 94 — 97 | .. | 4 2 6 |
| West India and Panama Teleg. | 10 | 1½ | .. | 2 3/16 — 2 7/16 xd | — 1/16 | 4 17 6 |
| Do. 6 % Cum. 1st Pref. | 10 | 6 | 6 | 9½ — 10 xd | .. | 6 0 0 |
| Do. 6 % Cum. 2nd Pref. | 10 | 6 | 6 | 9 — 9½ xd | .. | 6 6 4 |
| Do. 5 % Debs. | 100 | 5 | 5 | 98 —100 | .. | 5 0 0 |
| Western Telegraph, Ltd. | 10 | 7† | 7 | 12⅜ — 13⅛ | + ⅛ | 5 5 8 |
| Do. 4 % Debs. | Stock | 4 | 4 | 94 — 96 | .. | 4 3 4 |
| Western Union 4½ % Fdg. Bonds | $10.0 | 4½ | 4½ | 92 — 95 | .. | 4 14 9 |

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

*Continued on next Page.*

# SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

| NAME. | Stock or Share. | Dividends for 1912. | Dividends for 1913. | Closing Quotations Nov. 18th. | Rise + or Fall — | Present Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|
| | * | | | | | |
| Bath Trams, Pref. Ord. | 1 | Nil | .. | 3/16 — 5/16 | .. | Nil |
| Do. 5 % Pref. | 1 | 5 | 5 | 31/32 — 1 | .. | 6 8 0 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 70 — 75 | .. | 6 0 0 |
| Brit. Elec. Trac., 6 % Pref. | 100 | .. | .. | 10¾ — 12½ | — ½ | .. |
| Do. Do. Deferred | 100 | .. | .. | 3¾ — 5½ | — ½ | .. |
| Do. Do. 6 % Cum. Pr'f. | 100 | 6 | 6 | 87 — 90 | +1 | 6 13 4 |
| Do. 7 % Non-Cum. Pr'f. | 100 | 8 | .. | 48 — 51 | .. | 5 17 8 |
| Do. 5 % Perp. Deb. | 100 | 5 | 5 | 90 — 93 | +1 | 5 7 6 |
| Do. 4½ % 2nd Deb. | 100 | 4½ | 4½ | 75 — 78 | .. | 5 15 5 |
| Central London Railway, Ord. | 100 | 8 | 8 | 61 — 66 | .. | 4 11 0 |
| Do. Gtd. Assented | 100 | .. | 4 | 78 — 80 | .. | 5 0 0 |
| Do. Pref. | 100 | 4 | 4 | 70 — 75 | .. | 5 6 8 |
| Do. Gtd. Assented | 100 | .. | 4 | 81 — 83 | .. | 4 16 3 |
| Do. Def. | 100 | 2 | .. | 60 — 65 | .. | 3 1 7 |
| Do. Gtd. Assented | 100 | .. | 4 | 77 — 79 | .. | 5 1 3 |
| Do. 4 % Deb. | 100 | 4 | 4 | 97 — 99 | .. | 4 0 10 |
| City & S. London, 5 % Pref., 1891 | 100 | 5 | 5 | 96 — 98 | .. | 5 2 0 |
| Do. Do. 1896 | 100 | 5 | 5 | 96 — 98 | .. | 5 2 0 |
| Do. Do. 1901 | 100 | 5 | 5 | 95 — 97 | .. | 5 3 1 |
| Do. Do. 1903 | 100 | 5 | 5 | 95 — 97 | .. | 5 3 1 |
| Do. 4 % Deb. | 100 | 4 | 4 | 90 — 92 | .. | 4 7 0 |
| Hastings Trams, 6 % Pref. | 1 | 6 | 6† | ¼ — 3/8 | .. | 8 0 0 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 66 — 71 | .. | 6 6 9 |
| Isle of Thanet Trams, 5 % Pref. | 5 | 2½ | .. | 2 7/16 — 2 9/16 | .. | 4 17 7 |
| Do. 4 % Deb. | 100 | 4 | 4 | 73 — 78 | .. | 5 2 7 |
| Lancashire United, 5 % Deb. | 100 | 5 | 5 | 77 — 81 | .. | 6 3 5 |
| London and Suburban, Ord. | 1 | .. | .. | 3/8 — 5/8 | — 1/16 | .. |
| Do. Do. 5 % Cum. Pref. | 1 | .. | 5† | 1/2 — 5/8 | — 1/32 | .. |
| Do. Do. 4½ % 1st Deb. | 100 | 4½ | 4½ | 74 — 79 | −3 | 5 14 0 |

| NAME. | Stock or Share. | Dividends for 1912. | Dividends for 1913. | Closing Quotations Nov. 18th. | Rise + or Fall — | Present Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|
| | * | | | | | |
| London Elec. Railways, 4 % Deb. | 100 | 4 | 4 | 90 — 92 | .. | 4 7 0 |
| London United Trams, 4 % Deb. | 100 | 4 | 4 | 57 — 61 | .. | 6 11 2 |
| Metropolitan Railway Consol. | 100 | 1⅝ | 1½† | 40¼ — 40¾ | +1½ | 3 19 9 |
| Do. Surplus Lands | 100 | 2¼ | 2½† | 58 — 60 | .. | 4 11 8 |
| Do. 3½ % Deb. | 100 | 3½ | 3½ | 83 — 85 | .. | 4 2 4 |
| Do. 3½ % Pref. | 100 | 3½ | 3½ | 78 — 80 | .. | 4 7 6 |
| Do. 3½ % Con. Pref. | 100 | 3½ | 3½ | 75 — 77 | −1 | 4 11 0 |
| Metropolitan District Ord. | 100 | Nil | .. | 28⅛ — 29 | + ⅜ | Nil |
| Do. 6 % Deb. | 100 | 6 | 6 | 136 —139 | .. | 4 6 4 |
| Do. 4 % Deb. | 100 | 4 | 4 | 92 — 94 | .. | 4 5 |
| Do. 4 % Prior Lien | 100 | 4 | 4 | 93 — 95 | .. | 4 4 3 |
| Do. 4½ % First Pref. | 100 | 4½ | 4½ | 81 — 83 | .. | 5 8 5 |
| Do. 3½ % Gtd. | 100 | 3½ | 3½ | 74 — 76 | .. | 4 12 1 |
| Metro. Elec. Trams, 4½ % Deb. | 100 | 4½ | 4½ | 82 — 86 | .. | 5 4 8 |
| Do. 5 % Deb. | 100 | 5 | 5 | 86 — 89 | .. | 6 12 0 |
| Potteries, Ord. | 1 | 3½ | .. | 7/16 — 7/16 | .. | .. |
| Do. 5 % Pref. | 1 | 5 | 5 | 3/16 — 5/16 | .. | 7 5 6 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 80 — 83 xd | .. | 5 8 5 |
| South Metro. Trams, 6 % Pref. | 1 | 6 | 6† | 1/8 — 3/8 | .. | 8 0 0 |
| Do. 4 % Deb. | 100 | 4 | 4 | 68 — 72 | .. | 5 11 1 |
| Underground Elec. Railways | 10 | .. | .. | 3 3/8 — 3 5/8 | + 1/8 | Nil |
| Do. "A" | 1/- | .. | .. | 3/32 — 3/32 | .. | Nil |
| Do. 6 % First Cum. Inc. Deb. | 100 | 6 | 6 | 111 —113 | +1 | 5 6 2 |
| Do. 4½ % Bonds | 100 | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| Do. 6 % Income | 100 | 6 | 6 | 89 — 90 | +1 | 6 13 4 |
| Yorkshire (West Riding), Ord. | 5 | Nil | .. | 1/4 — 1/2 | .. | Nil |
| Do. 6 % Pref. | 5 | 3 | 1½† | 8½ — 4 | .. | .. |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 81 — 86 | .. | 5 4 8 |

## ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Arg. Trams, 1st Pref. | 5 | 5⅛ | 5⅛ | 4 3/8 — 4 7/16 | .. | 5 12 10 |
| Do. 2nd Pref. | 5 | 5⅝ | 5⅝ | 4 3/16 — 4 7/16 | .. | 6 3 11 |
| Do. 4 % Deb. | 100 | 4 | 4 | 89½ — 91½ | .. | 4 7 5 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 97⅛ — 99½ | .. | 4 10 6 |
| Do. 5 % Deb. | 100 | 5 | 5 | 98⅜ — 100⅝ | .. | 4 19 6 |
| Auckland Trams, 5 % Deb. | 100 | 5 | 5 | 101 —103 | +1 | 4 17 1 |
| Bombay Elec. S. & Trams, Pref. | 10 | 6 | 6 | 10⅜ — 11⅜ | .. | 5 4 4 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 94 — 96 | .. | 4 13 9 |
| Do. 5 % 2nd Deb. | 100 | 5 | 5 | 97 —100 | +1 | 5 0 0 |
| Brazilian Traction, Light and Power | $100 | 6 | 6† | 86½ — 88⅝ | +2⅛ | 6 15 6 |
| Brisbane Trams Invt., Ord. | 5 | 8 | 8 | 7½ — 7⅝ | .. | 5 3 3 |
| Do. 5 % Pref. | 5 | 5 | 5 | 4⅞ — 5⅛ | .. | 4 13 0 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 98 —101 | .. | 4 9 1 |
| B. Columbia Elec. Rly., Def. | 100 | 8 | 8† | 114 —119 | −1 | 6 14 6 |
| Do. Pref. Ord. | 100 | 6 | 6 | 102 —107 | .. | 5 12 2 |
| Do. 5 % Pref. | 100 | 5 | 5 | 99¼—102½ | + ⅛ | 4 17 6 |
| Do. 4½ % 1st Mort. Deb. | 40 | 4½ | 4½ | 97 —100 | .. | 4 10 0 |
| Do. 4½ % Vancouver Deb. | 100 | 4½ | 4½ | 100 —104 | .. | 4 6 7 |
| Do. 4½ % Con. Deb. | 100 | 4½ | 4½ | 92 — 95 | +2 | 4 9 6 |
| Calcutta Trams, Ord. | 5 | 7½ | 5† | 5⅞ — 6⅛ | — ⅛ | 5 17 8 |
| Do. 5 % Pref. | 5 | 5 | 5 | 4 13/16 — 5 3/16 | — 1/16 | 4 16 5 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 96 — 99 | .. | 4 11 0 |
| Cape Electric Trams | 1 | 5 | 5 | 3½ — 3⅝ xd | .. | 6 19 0 |
| City Buenos Aires Trams (1904) | 5 | 5† | 5 | 5 1/16 — 5 7/16 xd | .. | 4 14 1 |
| Do. 4 % Deb. | 100 | 4 | 4 | 92 — 97 | .. | 4 2 6 |
| Colombo Elec. Tr. & Lt., 5 % Deb. | 100 | 5 | 5 | 88 — 92 | .. | 5 8 8 |
| Havana Elec. Rly., 5 % Bonds | $1000 | 5 | 5 | 94½ — 98½ | .. | 5 1 6 |
| Kalgoorlie Elec. Trams | 1 | Nil | .. | 0 — 1/16 | .. | Nil |
| Do. 5% A Deb. | 100 | 5 | 5 | 85 — 90 | .. | 5 11 1 |
| Do. 6% B Deb. | 100 | 3 | .. | 10 — 20 | .. | .. |

| | | | | | | |
|---|---|---|---|---|---|---|
| La Plata Elec. Trams, Ord. | 1 | .. | .. | 3/8 — 1/2 | .. | .. |
| Do. Pref. | 1 | 4½d. | 6 | 1/2 — 1 | .. | 6 0 0 |
| Lisbon Elec. Trams, Ord. | 1 | 6 | 6† | 1 — 1½ xd | .. | 4 16 1 |
| Do. 6 % Pref. | 1 | 6 | 6 | 1 5/16 — 1 3/8 | .. | 5 1 0 |
| Do. 5 % Deb. | 100 | 5 | 5 | 91 — 96 | .. | 5 4 2 |
| Madras Elec. Tr., 6% Cum. Pref. | 5 | 6 | 6 | 4½ — 5⅛ | .. | 5 17 1 |
| Do. Elec. Tr. (1904), Deb. | 100 | 5 | 5 | 101 —103 | .. | 4 17 1 |
| Manaos Trams & Lt., 1st Deb. | 100 | 5 | 5 | 85 — 87 | −2 | 5 15 0 |
| Manila Elec. R. and Ltg., Bonds | $1000 | 5 | 5 | 96⅛ — 98⅜ | .. | 5 1 6 |
| Mexico Trams Com | $100 | 7 | 7 | 78 — 82 | +4 | 8 10 8 |
| Do. Gen. Con. 5 % Bonds | .. | 5 | 5 | 80 — 85 | +7 | 5 17 8 |
| Do. 6 % Bonds | 100 | 6 | 6 | 81 — 84 | +2 | 7 2 10 |
| Para Elec. Rlys. & Lt., Ord. | 5 | 10 | 10† | 5⅞ — 6⅛ | + ⅜ | 8 0 0 |
| Do. 6 % Pref. | 5 | 6 | 6 | 4⅞ — 5⅛ | .. | 5 17 1 |
| Do. 5 % 1st Deb. | 100 | 5 | 5 | 94⅛ — 96 xd | .. | 5 3 8 |
| Perth (W.A.) Elec. Tr., Ord. | 1 | 5⅛ | .. | 1⅛ — 1⅜ | .. | 4 0 0 |
| Rangoon El. Tr. & Sup., Pref. | 5 | 6 | 6 | 5⅛ — 5⅜ | .. | 5 6 8 |
| Do. 4½ % 1st Deb. | 100 | 4½ | 4½ | 97 — 99 | .. | 4 10 11 |
| Rio de Janeiro Trams, 1st Mort. 5 % Bonds | .. | 5 | 5 | 98 —100 | .. | 5 0 0 |
| Do. 5 % Mort. Bonds | 100 | 5 | 5 | 88 — 90 | .. | 5 11 1 |
| Sao Paulo Tram., Lt. and P. 5 % 1st Deb. | $500 | 5 | 5 | 99 —102 | +1 | 4 18 0 |
| Singapore Trams, 5 % Deb. | 100 | 5 | 5 | 86 — 90 | .. | 5 11 1 |
| Southern El. Tr. B.A., 5 % Deb. | 100 | 5 | 5 | 93 — 95 | .. | 5 5 3 |
| Un. Elec. Trams Monte Video | 5 | 7 | 7 | 4⅞ — 5⅛ | .. | 6 13 4 |
| Do. 6 % Pref. | 5 | 6 | 6 | 4⅞ — 5⅛ | — ⅛ | 5 14 3 |
| Do. 5 % 1st Deb. | 100 | 5 | 5 | 93½ — 96½ | .. | 5 8 8 |
| Winnipeg Elec. Rly., 4½ % Deb. | 100 | 4½ | 4½ | 97⅜ — 99⅝ | −1 | 4 10 7 |

## MANUFACTURING COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Aron, Ord. | 1 | 7 | .. | 9/16 — 13/16 | .. | 8 12 4 |
| Do. 6 % Pref. | 1 | 6 | 6 | 31/32 — 1 3/32 | .. | 7 18 4 |
| Babcock & Wilcox | 1 | 16 | .. | 2 7/8 — 3 | .. | 5 6 8 |
| Do. Pref. | 1 | 6 | 6 | 1 15/16 — 1 7/8 | .. | 4 3 6 |
| British Aluminium, Ord. | 1 | .. | .. | 1 3/8 — 1 1/2 | .. | .. |
| Do. 6 % Cum. Pref. | 1 | 6 | 6 | 1 3/16 — 1 5/16 | .. | 6 8 0 |
| Do. 5 % Prior Liens Debs. | 100 | 5 | 5 | 93 — 96 | .. | 5 4 2 |
| Do. Deb. Stk. | 100 | 5 | 5 | 85 1/2 — 87 1/2 | .. | 5 14 3 |
| B.I. & Helsby Cables | 5 | 10 | .. | 8 — 8 1/2 | .. | 5 17 8 |
| Do. Pref. | 5 | 6 | 6 | 5 3/8 — 6 1/4 | — 1/4 | 4 16 0 |
| Do. Deb. | 100 | 4½ | 4½ | 100 —103 | .. | 4 7 5 |
| British Thomson-Houston, Deb. | 100 | 4½ | 4½ | 92 — 95 | .. | 4 14 9 |
| British Westinghouse, Pref. | 3 | Nil | .. | 1 — 1 1/16 | + 1/16 | Nil |
| Do. Deb. | 100 | 4 | 4 | 66 — 69 | .. | 5 15 11 |
| Do. 6 % Prior Lien | 100 | 6 | 6 | 100 —103 | .. | 5 16 6 |
| Browett, Lindley, Ord. | 1 | .. | .. | 2/- —3/- | .. | Nil |
| Do. Pref. | 1 | .. | .. | 8/- —8/6 | .. | Nil |
| Brush, 7 % Pref. | 2 | Nil | .. | 0 — 1/8 | .. | Nil |
| Do. 5 % Prior Lien Deb. | 100 | 5 | 5 | 70½ — 75½ | .. | 6 12 5 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 85½ — 40½ | .. | 11 2 2 |
| Do. 4½ % Second Deb. | 100 | 4½ | 4½ | 23 — 27 | .. | 16 13 4 |
| Callender's Cable | 5 | 15 | 5† | 10⅜ — 11⅛ | .. | 6 10 5 |
| Do. Pref. | 5 | 5 | 5 | 5 — 6¼ | .. | 4 15 3 |
| Do. Deb. | 100 | 4½ | 4½ | 96 — 99 | .. | 4 10 6 |
| Castner-Kellner | 1 | 20 | 22½ | 3½ — 4 | + 1/16 | 5 12 6 |
| Do. Deb. | 100 | 4½ | 4½ | 102 —105 | .. | 4 5 9 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Crompton & Co., Deb. | 100 | 5 | 5 | 64 — 69 | +2 | 7 5 0 |
| Dick, Kerr | 1 | Nil | .. | 3/16 — 5/16 | .. | .. |
| Do. Pref. | 1 | 6 | 6 | 5/8 — 3/4 | .. | 7 2 2 |
| Edison & Swan, A, £2 paid | 5 | Nil | .. | 0 — 1/8 | .. | Nil |
| Do. fully paid | 5 | Nil | .. | 1/4 — 1/8 | + 3/8 | Nil |
| Do. 4 % Deb. | 100 | 4 | 4 | 58 — 62 | .. | 6 9 1 |
| Do. 5 % Second Deb. | 100 | 5 | 5 | 63 — 68 | .. | 7 7 1 |
| Electric Construction | 1 | 5 | .. | 1/2 — 1 1/8 | .. | 7 5 6 |
| Do. Pref. | 1 | 7 | 7 | 1 1/16 — 1 1/16 | .. | 6 11 9 |
| Greenwood & Batley, Pref. | 10 | 7 | 7 | 6 3/4 — 7 1/4 | .. | 9 13 2 |
| Do. Deb. | 100 | 5 | .. | 92 — 94 | .. | 5 4 2 |
| General Electric, 6 % Pref. | 10 | 6 | 6 | 9 1/4 — 10 3/8 | .. | 5 15 8 |
| Do. Deb. | 100 | 4 | 4 | 88 — 93 | .. | 4 6 0 |
| Henley's, Ord. | 5 | 15 | 10† | 12 3/8 — 13 1/8 | + 1/4 | 5 11 1 |
| Do. Pref. | 5 | 4½ | 4½ | 4 13/16 — 5 1/16 | .. | 4 8 11 |
| Do. Deb. | 100 | 4½ | 4½ | 101 —103 | .. | 4 7 5 |
| India-Rubber, G. & T. | 10 | 7½ | 5 | 13 — 14 | .. | 5 7 2 |
| Do. Pref. | 10 | 5 | 5 | 9 1/4 — 10 | .. | 5 0 0 |
| Telegraph Construction | 12 | 20 | 5† | 37 — 39 | .. | 6 3 1 |
| Do. Deb. | 100 | 4 | 4 | 96 — 98 | .. | 4 1 8 |
| Willans & Robinson, 4 % 1st Mort. Deb. | 100 | 4 | 4 | 55 — 60 | .. | 6 13 4 |
| Do. B 4 % Cum. Pref. | 100 | .. | .. | 12 — 17 | +1 | .. |

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd, 1913.

# EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING OCTOBER, 1913.

The returns of electrical exports and imports for the month of October show an all-round improvement as compared with the preceding month; the exports amounted to £554,769, as against the September total of £445,155, and included telegraphic material valued at £123,679, as compared with, approximately, £70,000 worth in September. The re-exports, at £39,337, reached the highest value we have so far recorded, and were some £9,000 in excess of the previous month's total. Compared with the previous month, nearly every section of the exports showed an improvement in value, the only exception being accumulators; of the total increase in value for the month, about one-half was due to the increased telegraphic exports, which included a single item of submarine cable valued at 53,000.

In the case of the imports—which reached a total of £266,216, as compared with £252,741 in the previous month—the machinery and accumulator sections showed to advantage, cable imports were stationary, while telegraphic and telephonic imports fell away, as compared with September.

In view of its large cable purchase, Denmark was one of our best customers during the month, a distinction which was shared by Argentina, India and New South Wales.

## Registered Exports of British and Irish Electrical Goods from the United Kingdom.

| Destination of exports and country consigning imports. | Electrical goods and appliances. | Wires and cables, rubber and other insulations. | Electric lighting fittings and accessories. | Electric glow lamps. | Electric arc lamps and lamp parts. | Electric meters and instruments. | Electric machinery. | Electrically-driven machinery. | Batteries and accumulators. | Carbons. | Telephonic cable and apparatus and electric bells | Telegraphic cable and apparatus. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ |
| Russia, Sweden, Norway and Denmark ... | 1,596 | 297 | 294 | 91 | 3,960 | 1,035 | 13,864 | 159 | ... | 37 | 22 | 53,734 | 75,089 |
| Germany ... ... ... ... ... | 5,649 | 3,887 | ... | 14 | 583 | 63 | 4,122 | ... | 116 | 22 | 120 | 242 | 14,818 |
| Netherlands, Java and Dutch Indies ... | 610 | 801 | 450 | 30 | 24 | 171 | 1,590 | 923 | 30 | ... | 52 | 179 | 4,860 |
| Belgium ... ... ... ... ... | 405 | 366 | 106 | 45 | 184 | 21 | 3,892 | 50 | 200 | 323 | 2,048 | 89 | 7,729 |
| France ... ... ... ... ... ... | 725 | 172 | 4,554 | 28 | 2,000 | ... | 5,251 | 1,048 | ... | ... | 158 | 7 | 13,943 |
| Portugal ... ... ... ... ... | 1 338 | 161 | 10 | 42 | ... | 6 | 707 | 2,861 | 471 | ... | 197 | 445 | 6,238 |
| Spain, Canary Isles and Spanish N. Africa... | 1,534 | 629 | 208 | ... | ... | 349 | 4,031 | 120 | 11 | 10 | 240 | 20 | 7,152 |
| Switzerland, Italy and Austria-Hungary ... | 221 | 246 | 115 | ... | 12 | 6 | 4,427 | 820 | ... | 443 | 714 | 1,601 | 8,605 |
| Greece, Roumania and Turkey ... ... | 404 | 1,514 | 193 | ... | ... | ... | 440 | ... | 174 | ... | 6,238 | 1,812 | 10,775 |
| Channel Isles, Gibraltar, Malta and Cyprus... | 58 | 47 | 32 | 20 | ... | 37 | 251 | ... | 153 | ... | 28 | 708 | 1,334 |
| U.S.A., Philippines and Cuba ... ... | 1,160 | 356 | 156 | 56 | 20 | 124 | 1,999 | ... | ... | ... | 214 | 435 | 4,520 |
| Canada and Newfoundland ... ... ... | 2,107 | 778 | 569 | 769 | 30 | 1,100 | 8,541 | 804 | 304 | 67 | 818 | 60 | 15,947 |
| British West Indies and British Guiana ... | 1,081 | 88 | 45 | 73 | 22 | ... | 408 | 36 | 48 | ... | 121 | ... | 1,922 |
| Mexico and Central America ... ... | 22 | 103 | 47 | 33 | ... | ... | 614 | 30 | 28 | ... | ... | ... | 877 |
| Peru and Uruguay ... ... ... ... | 296 | 15 | 14 | ... | ... | 822 | 1,581 | 197 | 10 | ... | 543 | 40 | 3,518 |
| Chile ... ... ... ... ... ... | 607 | 128 | 693 | 165 | ... | 185 | 3,388 | 1,659 | 230 | ... | 269 | 777 | 8,101 |
| Brazil ... ... ... ... ... ... | 1,389 | 1,263 | 297 | 675 | 32 | 622 | 7,032 | 488 | 199 | ... | 135 | 18,732 | 30,864 |
| Argentina ... ... ... ... ... | 5,401 | 11,576 | 553 | 854 | 182 | 692 | 23,331 | 3,915 | 2,386 | ... | 4,792 | 4,371 | 58,053 |
| Colombia, Venezuela, Ecuador and Bolivia... | 20 | ... | 48 | ... | ... | 126 | 213 | ... | ... | ... | 15 | ... | 422 |
| Egypt, North Africa and Persia ... ... | 243 | 39 | 455 | 129 | 21 | ... | 743 | 8 | 256 | ... | 460 | 8,591 | 10,945 |
| British West Africa ... ... ... ... | 64 | 185 | 33 | ... | ... | 492 | 2,090 | 122 | 160 | 94 | 457 | 671 | 4,368 |
| Rhodesia, O.R.C. and Transvaal ... ... | 1,127 | 419 | 563 | 723 | 22 | 757 | 3,906 | 399 | 145 | 15 | 265 | 77 | 8,418 |
| Cape of Good Hope ... ... ... ... | 1,156 | 2,692 | 736 | 202 | ... | 611 | 3,335 | 1,913 | 731 | 11 | 1,932 | 4,095 | 17,414 |
| Natal ... ... ... ... ... ... | 1,253 | 3,654 | 385 | ... | ... | 255 | 1,867 | 99 | 706 | ... | 138 | 13 | 8,370 |
| Zanzibar, Brit. E. Africa, Mauritius & Aden | 117 | 133 | 61 | 147 | 10 | 29 | 550 | ... | 20 | ... | 66 | 1,730 | 2,863 |
| Azores, Madeira and Portuguese Africa ... | 661 | ... | 229 | 105 | ... | 48 | 621 | ... | 32 | ... | 118 | 423 | 2,237 |
| French African Colonies and Madagascar ... | 9 | ... | ... | ... | ... | ... | 44 | ... | ... | ... | 20 | 6,842 | 6,915 |
| China and Siam ... ... ... ... | 1,741 | 508 | 523 | 349 | 56 | ... | 1,649 | 678 | 1,470 | 54 | 385 | 2,446 | 9,859 |
| Japan and Korea ... ... ... ... | 656 | 821 | 12 | 139 | 18 | 1,464 | 18,105 | 938 | 827 | 84 | 5,304 | 507 | 28,875 |
| India ... ... ... ... ... ... | 4,461 | 4,140 | 5,323 | 1,329 | 200 | 1,278 | 26,038 | 3,501 | 2,137 | 238 | 2,135 | 3,508 | 54,288 |
| Ceylon ... ... ... ... ... ... | 354 | 522 | 235 | 56 | ... | 31 | 201 | 510 | 204 | 15 | 123 | 4,584 | 6,835 |
| Straits Settlements, Fed. Malay States, and Sarawak ... ... ... | 1,292 | 2,164 | 608 | 263 | ... | 183 | 361 | 949 | 225 | 4 | 2,887 | 659 | 9,595 |
| Hong Kong ... ... ... ... ... | 693 | 3,122 | 213 | 16 | ... | 353 | 2,133 | 149 | 10 | 39 | 13 | ... | 6,741 |
| West Australia ... ... ... ... | 205 | 1,037 | 136 | 237 | 32 | ... | 327 | 46 | 196 | 140 | 2,377 | 434 | 5,167 |
| South Australia ... ... ... ... | 366 | 4,190 | 278 | 432 | 18 | 660 | 1,707 | 141 | 504 | 23 | 239 | 44 | 8,602 |
| Victoria ... ... ... ... ... | 2,495 | 4,547 | 650 | 945 | 300 | 1,018 | 3,034 | 292 | 1,010 | ... | 6,088 | 1,241 | 21,620 |
| New South Wales ... ... ... ... | 2,019 | 11,612 | 758 | 2,042 | 285 | 1,606 | 7,915 | 1,803 | 827 | 32 | 1,063 | 3,740 | 33,700 |
| Queensland ... ... ... ... ... | 826 | 33 | 204 | 329 | 135 | 24 | 2,422 | 6 | 304 | 82 | 8,934 | 87 | 13,386 |
| Tasmania ... ... ... ... ... | 259 | ... | 13 | 37 | ... | ... | ... | ... | ... | ... | ... | 24 | 333 |
| New Zealand and Fiji Islands ... ... | 1,286 | 2,738 | 510 | 1,174 | 132 | 186 | 9,036 | 857 | 515 | ... | 2,326 | 711 | 19,471 |
| Total, £ | 45,906 | 64,983 | 20,309 | 11,549 | 8,276 | 14,354 | 171,766 | 25,521 | 14,639 | 1,733 | 52,054 | 123,679 | 554,769 |

## Registered Imports into the United Kingdom of Electrical Goods from all Countries.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Russia, Norway, Sweden and Denmark ... | 3 | ... | ... | ... | 29 | ... | 9,330 | 229 | 885 | ... | 3,723 | 14,199 |
| Germany ... ... ... ... ... | 3,443 | 31,067 | 1,968 | 14,633 | 8,523 | 2,762 | 57,286 | 62 | 12,974 | 8,189 | 7,502 | 148,409 |
| Holland ... ... ... ... ... | ... | ... | ... | 698 | 873 | 356 | 250 | ... | 5 | 140 | ... | 2,322 |
| Belgium ... ... ... ... ... | 631 | 3,045 | ... | 299 | 30 | ... | 5,835 | ... | 886 | 198 | 4,308 | 15,232 |
| France ... ... ... ... ... ... | 212 | 50 | 1,580 | 1,618 | 459 | 1,666 | 754 | ... | 1,480 | 3,444 | 9,832 | 21,095 |
| Switzerland ... ... ... ... ... | 362 | 3,486 | 39 | 6 | 4 | 372 | 1,009 | ... | ... | 387 | 931 | 6,596 |
| Italy ... ... ... ... ... ... | ... | 3,426 | ... | ... | 185 | 50 | ... | ... | ... | 85 | 25 | 3,771 |
| Austria-Hungary ... ... ... ... | ... | 934 | ... | 847 | 18 | ... | ... | ... | 352 | 325 | 72 | 2,548 |
| United States ... ... ... ... ... | 9,512 | 362 | 1,702 | 58 | 563 | 62 | 17,261 | 19,632 | 645 | 18 | 1,427 | 51,242 |
| Total, £ | 14,163 | 42,370 | 5,289 | 18,159 | 10,684 | 5,268 | 91,725 | 19,923 | 17,227 | 12,786 | 27,820 | 265,414 |

Additional imports: Spain, carbons £442; New South Wales, meters £25, machinery £110; Canada, electrical goods £105, machinery £120.

## Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Various countries, mainly as above ... | 16,599 | 631 | ... | 2,320 | 334 | ... | 9,733 | ... | 842 | 693 | 8,185 | 39,337 |

Total Exports: £554,769. Total Re-Exports: £39,337. Total Imports: £266,216.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

## THE WINDING DIAGRAM IN THE WORKS.

By G. MOORES, B.Sc. Lond.

The object of this article is to show that A.C. winding diagrams might be made much simpler and more useful for works purposes than is at present the case by an extended use of what may be called the "group" type of diagram, of which fig. 1 is an example. Probably the clearest way of showing this will be to explain the diagram, which is already in use to a limited extent, first from the works point of view, and indicate the

*Method of Using the Diagram.*—Taking for the purpose of this article a particular example, we may assume the case of a four-pole, three-phase induction motor stator with, say, 60 slots, wound with two bars per slot pushed through and bent over at the ends of the slots to form a wave winding of the "barrel" type, all the conductors in each phase being in series, and the phases star connected.

A statement of the pitch of the winding, a standard direction of bending the bars outside the slots, and the dia-

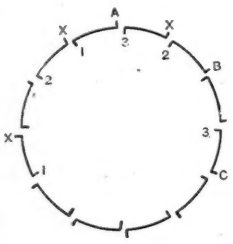


Fig. 1.

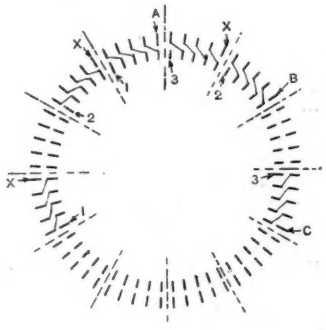


Fig. 2.

gram shown in fig. 1, are all that is necessary to enable the works to wind and connect the machine correctly. The procedure would be as follows :—

1. The bars would be inserted in the slots and bent in the standard direction to suit the given pitch. A view of either end of the machine would then show the ends of 120 bars arranged in two circles (fig. 2).

2. At the connection (or front) end of the machine, these bar ends would be divided into as many groups as there are lines in the diagram (fig. 1), *i.e.*, in this case 12. The division is shown by the broken lines.

3. The corner bars in each group would be lettered according to the diagram—as shown in fig. 2.

4. All the bars at the rear of the machine, and all the bars in the unlettered groups at the front of the machine would then be connected in pairs, a pair consisting of two bar ends on the same radius, with connectors of the form

5. In each "lettered" group, the unlettered bars in the bottom row would be connected individually with the unlettered bars in the top row, as shown, either with connectors of the form or by moving the upper bars radially over the lower bars and using the same kind of connectors as in (4).

After (5) there remains a number (in this case 12) of lettered bar ends, which must be connected by external connectors (cable, wire, or strap) as follows :—

6. The bars lettered from the beginning of the alphabet, viz., A, B, &c., are connected to the machine terminals.

7. All the other bars of the same letter or figure are connected together. Thus the three bars X are connected together to form the star point ; the two bars (1) are connected together ; the two bars (2) are connected together ; and so on.

The winding and connections would then be complete without reference having been made to any diagram except that shown in fig. 1.

In the case of small machines in which the external connections of (6) and (7) are of small wire or cable, fig. 1 is all that is necessary for the works. In the case of larger machines a working drawing may also be necessary to show the mechanical arrangement, method of support, and so on, of the conductors and external connections.

*Method of Constructing the Diagram.*—The above explanation has been given from the works point of view, and shows the simplicity of the procedure. The method of constructing the diagram is equally simple, being as follows :—

1. Sketch out the usual round type of diagram for one phase only and for two conductors per pole, as in fig. 3.

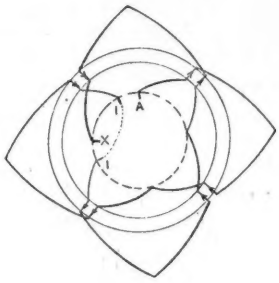


Fig. 3.

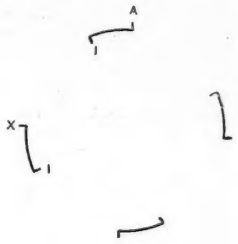


Fig. 4.

2. Letter the beginning of the winding A, the end X, and mark with the same figure (in this case 1) the intermediate points which are joined together by an external connector (1-1 shown dotted).

3. Draw a number of arcs of a circle equal to the number of poles, and letter the arcs to correspond to the letters in fig. 3, thus :—

4. In fig. 3 the marking on the circuit (following the circuit round in the direction of the arrows) is A-1-1-X. Similarly phase 2 may be marked B-2-2-X, and phase 3, C-3-3-X. Then superimpose on fig. 4 two other similar figures for phases 2 and 3, and the result will be the complete diagram, as in fig. 1. It will be noticed from the figure that this must be done in such a way that the three phases begin (at A, B and C respectively) on three alternate groups ; the phases will then be 120° (electrically) apart.

*Principle of the Diagram.*—The principle on which this simple diagram is constructed may be understood by reference to fig. 5, which is the complete diagram of one phase of the winding represented by fig. 1, viz. :—Four-pole, three-phase,

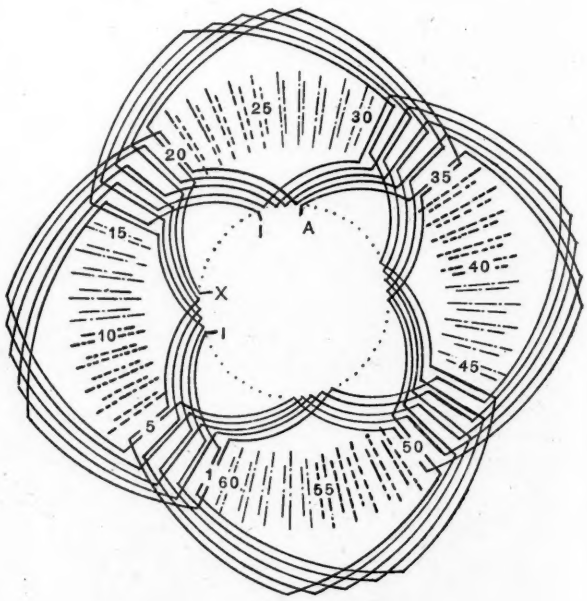


Fig. 5.

60 slots, 2 bars per slot, wave, Y connected, barrel winding. It will be seen that the ends of the bars (touching the innermost circle) are divided into four groups (= number of poles) which are represented by the four arcs in fig. 4, and with all three phases in there would be 12 groups, which are represented by the 12 arcs of fig. 1. The ends of the

groups to which external connections are made are marked in the diagram as follows :—

The letters A, B and C indicate the terminal connections ; the letter X indicates the star point ; and the figures indicate the bars which are joined together, 1 being joined to 1, 2 to 2, and so on.

The relative position of this marking (which shows the connections) is what the works requires to know, and this relative position is shown by fig. 1. The principle is, therefore, that one line is used to represent one complete group of coils (or conductors) and the lettering and figuring of the lines indicate the connections between the groups.

Hence, if the pitch of the winding is stated, and a standard direction of bending the bars adopted, fig. 1 is sufficient, as far as diagrams are concerned, for the machine to be correctly wound and connected.

*Advantages of the Diagram.*—Many advantages are at once apparent, and others are seen on examination of the working of the system. In the first place, the group diagram is obviously cheaper to make and less liable to contain error when made than the ordinary diagram of fig. 6, which is the one generally used, or the even worse diagram (to make) of fig. 5. Secondly, one diagram of the group type covers a larger number of cases than the full diagram, for whereas the latter varies with the number of slots per pole and the number of conductors per slot the former does not. In the case of the wave winding a modification of fig. 1, as shown in fig. 7, would cover all cases of three-phase, Y connected

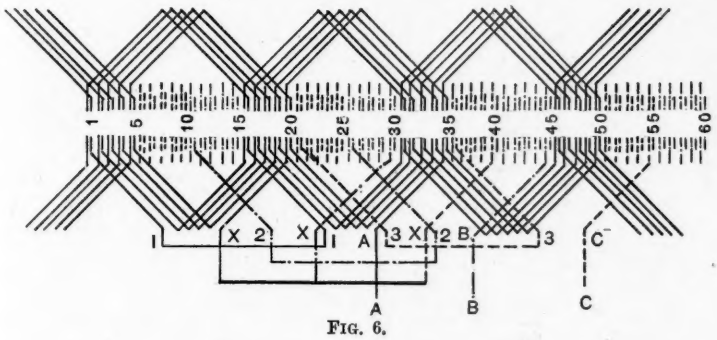


FIG. 6.

windings, in which all the conductors per phase are in series, not varying even with the number of poles.

Although fig. 7 would suffice, from an electrical point of view, for all cases, it would probably be found advisable for mechanical reasons to spread the terminal groups out a little more in the case of machines of, say, 10 poles and over, and to use a second diagram to represent these.

*Thus the one diagram of fig. 7, with perhaps another similar one, would suffice for the works in place of scores of the type of figs. 5 or 6, as at present generally used.*

Another advantage of the diagram of fig. 1 can be seen by comparing it with fig. 2. The latter may be considered as a drawing to scale of the end connectors of all the bars, therefore in the case of the bar-wound machine *fig. 1 is a drawing to scale, showing the actual relative position of the bar ends which have to be connected by external connectors.* The laying out of a working drawing of these external connections, and the calculation or measurement of their length, are therefore much simpler from fig. 1 than from fig. 6 (which is more often used than fig. 5).

The group diagram also gives less opportunity for error in the shops, for it is easier to read and it has no reference to slot numbers, the tracing of the winding from slot to connector being unnecessary. The practical importance of this advantage is apparent when one calls to mind the number of cases which occur of machines being wrongly connected even when diagrams are correct.

*General.*—The particular example used to illustrate this article is only one type of winding, but, with modifications, the same type of diagram could be used for all A.C. windings (except a few special cases)—one, two, or three-phase, wire or bars, wave or lap winding, stator or rotor, "barrel," "chain," or "concentric" types. The diagram is already in use for lap windings of the barrel type and of the basket or chain type, and also to a small extent for concentric windings, but it has not been used, as far as the writer is aware, for wave windings, where its use would effect the greatest saving. For that reason the particular case of a wave winding has been chosen for this article.

Group diagrams bear about the same relation to diagrams of the types of figs. 5 or 6 as working drawings to perspective views ; while the latter may be useful for text-book and similar purposes, they are obviously unnecessary for general use in the shop.

## ELECTRICITY AS A BY-PRODUCT.

By R. J. Spencer-Phillips.

(*Abstract of paper read before the* Institution of Municipal Engineers, *November 7th*, 1913.)

It is my object to point out shortly the various reasons why electricity can be sold by concerns whose main product has no connection whatever with electricity, and what use might be made of this fact by municipalities.

In the running of a power station, one of the chief objects to be aimed at is to secure a good "load factor." Usually the full output is only maintained for a very short portion of the 24 hours ; at other times the plant is running with a small load, and hence uneconomically as regards steam consumption and maintenance. In the case of a station with a bad load factor, a plant with a capacity double, and sometimes treble, the average output of the station has to be installed in order to be capable of dealing with the maximum demand, involving a correspondingly large capital cost.

The majority of the numerous mills and factories of all sorts scattered throughout the country run night and day, and have a load factor of from 60 per cent. to 80 per cent., which compares with the average supply company's

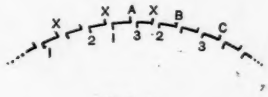


FIG. 7.

load factor of 20 per cent. In the case of fairly large mills, they find, by putting down their own plant, they can produce electricity at about 0·35d. per unit, including all capital charges—a figure which is far below the average cost of production as given in the technical Press for various supply companies.

Some time ago my firm were called in to advise a certain mill, situated in a country district, as to what they could do to economise their coal consumption. They had at the time three mill engines, driving by means of ropes and countershafts. We put before them the following table, the figures being taken from those supply stations whose average load was comparable, as nearly as possible, with the average load of the mill station :—

| | Average cost per unit from existing stations 20 % L.F. | Cost per unit 700-kw. mill station 80 % L.F. |
|---|---|---|
| Coal ... ... ... ... | ·3d. | ·175d. |
| Wages ... ... ... | ·2d. | ·025d. |
| Oil, waste, stores, &c. ... | ·02d. | ·006d. |
| Repairs and maintenance ... | ·15d. | ·048d. |
| Rent, rates, taxes ... ... | ·15d. | ·024d. |
| Total running cost ... | ·82d. | ·278d. |
| Management, offices, &c. ... | ·3d. | Nil |
| Int. 4 % on £15,000 ... | ·12d. | ·038d. |
| Dep. 5 % on £15,000 ... | ·15d. | ·048d. |
| Total cost ... ... | 1·39d. | ·364d. |

This table clearly shows that the total running cost of a station with an 80 per cent. load factor is, approximately, one-third the running cost of a station with a 20 per cent. load-factor.

The capital outlay in the above table is taken as being the same in each case, but in the generality of cases the power station would cost considerably more than the mill station, first, because, as previously mentioned, a larger plant would be required, and, secondly, because in the case of a mill very often use can be made of the existing engine room, thus dispensing with the cost of an entire new building.

We eventually put down for the owners of this mill a complete turbine-driven plant, comparable in every way with an electric supply station. As a result, the figures given were closely realised,

and the coal and repair bills were reduced by approximately £4,000, which was equivalent to a saving of just over 45 per cent.

The owners found that they could actually produce current at something like 0·35d. per unit, and that there were other mills not far off willing to pay enough for their supply to ensure the owners of the plant a good profit.

Therefore, being business men, they were not slow in putting two and two together, and now, with a slightly larger plant and larger output, they are able to run even more economically, and to sell their surplus energy as a by-product, and at a profit.

Thus, here we have an instance of an already prosperous concern making an additional profit entirely outside its normal line of business. Clearly, it would have paid the local authority to erect a power station at one of the mills, having these mills as its chief source of revenue, and undertaking the local lighting and power supply as an additional source of revenue. Here, then, is a field open for municipal enterprise. Where steam is required for heating purposes, a reducing turbine can be installed. The reducing turbine has a low-pressure stage enabling the steam either to exhaust to the heating system or to pass through the low-pressure stage to a condenser according to the heating requirements, and at the same time supply a constant electric load. This type is installed where the electrical requirements are in excess of the heating steam requirements.

In a number of mills the heating steam requirements are largely in excess of their power requirements. Supposing a market could be found for electrical energy, the total steam required could be raised to a high pressure and first utilised in back-pressure turbines, where the maximum amount of electricity possible would be generated. By this means the cost of production would be extremely low. A supply of electricity would be available for all the requirements of the mill, and there would be a large surplus of energy on the sale of which a very considerable profit could be made. An example of this kind appeared only a short time ago in the technical Press. I refer to the Salt Union Works at Winsford.* Here it was early realised that the amount of electrical energy available from the steam required for the process would be far in excess of the requirements of the works. Steps were therefore taken to obtain provisional orders for the Urban District Council of Runcorn and the town of Widnes. The total capacity of the plant now installed is two Browett and Westinghouse 725-KW. back-pressure reciprocating sets and two Browett & Westinghouse 1,500-KW. reducing turbines. This example shows very clearly what can be cone in this direction.

It is evident that wherever there are situated any mills or factories, in however small a town or district, such a place possesses great possibilities with regard to the production of electricity at a low cost. In these cases, therefore, it would appear an eminently sound policy for the local authority to undertake the supply of electricity, and, if possible, by entering into some form of agreement with the owners of the mill in question, to put down the necessary plant actually in the mill itself. There is then the course open of either installing an up-to-date boiler plant with back-pressure turbines, and selling both electrical energy and low-pressure heating steam, or if, as may well be the case, the mill already has a suitable boiler plant, an arrangement may be agreed upon by which payment is made for the use of the steam between 150 lb. pressure and 30 lb. pressure, or whatever the required range may be. The electrical energy produced by this steam is then sold, and the steam itself returned to the mill at the required back pressure.

## THE ELECTRICAL EXHIBITS AT THE OLYMPIA MOTOR-CAR EXHIBITION.

By CHAS. J. WEBB, A.I.A.E.

(*Continued from page* 773.)

BELOW are continued brief particulars of the different electric devices for the starting of the petrol engines and motor cars as displayed at the Motor Show at Olympia, which was brought to a successful conclusion on Saturday last.

*The Brolt.*—Still another new independent electric starter is that of Messrs. Brolt, Ltd., of Princip Street, Birmingham, the makers of the lighting set which bears their name. Interest in the system, which was exhibited by Messrs. Brown Bros., Ltd., the sole selling agents, lies in the means adopted of sliding the driving pinion into and out of mesh with a toothed ring on the engine fly-wheel. This is a problem on which much thought has had to be centred, and which has resulted in the evolution of a number of methods, some more or less complicated. The Brolt certainly strikes one as being one of the simplest and most effective that has so far been produced. The spindle of the armature is extended, and has cut on it a spiral thread; the driving pinion, which has a similar internal thread, is loose on the spindle. The arrangement may be compared with that of the familiar small Archimedian-screw hand-drill. Thus, when it is desired to start the engine, the current from the battery is switched on by pressing down a pedal; the instant the motor-spindle begins to revolve it automatically draws up the pinion into mesh with the toothed ring, the pinion, owing to its own inertia, not being revolved—and consequently not acting as a driver—until it is completely wound-up and in full engagement with the ring. As soon as the engine starts and attains a speed in excess of that which the motor can impart to it, the driving pinion is thrown automatically out of gear. Some fear has been expressed that the vibration resulting from the car travelling over bumpy roads may cause the driving pinion to have a slight movement along its spindle, and so bring it into touch with the toothed ring on the fly-wheel, to the detriment of its teeth; but this is a possibility—one will not say a probability—that can readily be overcome, while the fact that no levers or other mechanism are necessary to bring the pinion into engagement is a decided advantage. The motor, which works with a 12-volt current, is stated to be capable of starting four-cylinder engines up to 100 mm. bore, it being capable of developing 0·8 H.P., and of revolving the crankshaft of such an engine at 100-120 R.P.M. Another pattern is also made, in which an epicyclic reducing gear is incorporated with the motor; in this case the drive to the engine is by means of a V-shaped fibre wheel, which engages with a corresponding groove formed on the fly-wheel.

*The Rushmore.*—As it is proposed to fully describe the Rushmore electric starter, introduced by Rushmore Lamps, Ltd., London, in an early issue, it need only now be mentioned that it is essentially a series-wound motor, arranged to deliver for brief intervals only a maximum output of power; it is of the ironclad type, with four poles and an equal number of brushes. Interest in the system lies in the means adopted of bringing the driving pinion into and out of engagement with the toothed ring formed on the periphery of the engine fly-wheel.

*The Rotax-Leitner.*—The Siddeley-Deasy Motor Co., Ltd., Coventry, are adopting an electric starter on their 1914 cars; the arrangement, while acting on a toothed ring on the engine fly-wheel, differs in several ways from those that have already been dealt with. The motor, a Leitner, is located to the left, and rear of, the engine; its spindle is prolonged through the medium of a leather flexible joint, there being mounted on the end, a slidable sleeve carrying a small gear pinion which can be moved in and out of engagement with the fly-wheel. It is in the control gear that the novelty of the arrangement mainly lies; this is done by the usual clutch pedal, so that a separate pedal is not required. Normally, the clutch pedal is out of engagement with the starter, but by releasing a trigger on the dashboard, the pedal is, by a catch device operated through Bowden wire, brought into connection with the system of levers, by which the motor pinion is laterally moved. A further lever, linking up to the switch, is also provided in conjunction with the system, so that to start the engine, it is only necessary to move the dashboard trigger and press the clutch pedal down, the two operations of meshing the driving pinion and switching on the current following in quick succession. As soon as the engine starts, the motor pinion is moved out of mesh by simply releasing the clutch pedal for an instant.

*The Disco.*—Another example of the separate unit system is seen in the Disco, which was made by the company of that name, of Detroit, U.S.A., and which was shown on an Arrol-Johnston car. The drive is of the fly-wheel variety, the motor being a 12-volt machine of the two-pole, series-wound type, with the fields and pole-pieces in one casting. The makers state that the machine has no peculiar features, simply following good electrical practice, departing only in the matter of an extremely large factor of safety in the design of the bearings, brushes and commutator. A spur reduction gear is incorporated with the motor; the switch is so arranged that simultaneously with the sliding into mesh with the fly-wheel toothed ring, the motor is slowly rotated, the full power not being switched on until the wheels are in full engagement, a resistance coil being employed to give the slow motion. It is claimed that the motor can turn an engine at from 110 to 150 R.P.M., it being capable of developing a maximum of 2·2 H.P.; its weight is given as 37 lb., and its maximum efficiency as 77 per cent. The usual roller clutch is provided in conjunction with the driving pinion, so that the engine can overrun the motor after it has started up, until the pinion is disengaged from the fly-wheel.

*The Bijur.*—The Bijur electric starter, found on one of the Arrol-Johnston cars, is made by the Bijur Motor Lighting Co., of New York. It is very similar to the Disco and other types already alluded to, being connected to a toothed ring on the fly-wheel through a reduction gear, roller clutch, and sliding pinion.

Starting is accomplished by pressing a pedal which is connected by a lever to the motor-starting switch, and to a trunnion on the roller clutch shaft. Normally a spring holds the motor switch open and the pinion out of mesh with the fly-wheel. Depressing the pedal operates the switch and connects the battery to the motor through a resistance; the motor, therefore, rotates at moderate speed, ensuring a proper mesh between the pinion and the fly-wheel teeth, after which the resistance in series with the motor is cut out of circuit, leaving the motor connected directly across the terminals of the battery. The motor then spins the fly-wheel and after the engine starts a spring returns the pinion and switch to their original positions. This system is made to work with either 6 or 12-volt batteries.

*The Westinghouse.*—Although the Westinghouse Co. are making various equipments for motor cars—combination lighting and ignition, and combined lighting and starting—they are also manufacturing sets of the separate unit type, and it is the latter only that one found at the Show, this being on the Hupmobile (American) cars. Confining attention to the starting motor, this is of the "four-pole consequent pole" six-volt type, with only two field coils, the commutator and brushes being enclosed in detachable

* ELEC. REV., September 5th, 1913.

covers. The motor is located at the left side and drives a toothed ring on the fly-wheel by means of a double reduction gear. The short intermediate spindle carries two pinions, one of which is fixed, while the other can, by a system of levers, be slid into engagement with the fly-wheel. The sliding pinion is controlled by a pedal, with which the starting switch is connected, one motion of the pedal being thus all that is necessary. The switch is provided with preliminary contacts, which are engaged before the sliding gear is moved, so that by the time the gears begin to mesh the motor has commenced to run slowly, this greatly facilitating the meshing operation. The full current is only admitted to the motor when the gears are in full engagement, thus preventing damage to the teeth. The wiring is of the earthed return type, with the exception that a full copper return to the battery is used to minimise the drop in the voltage when the

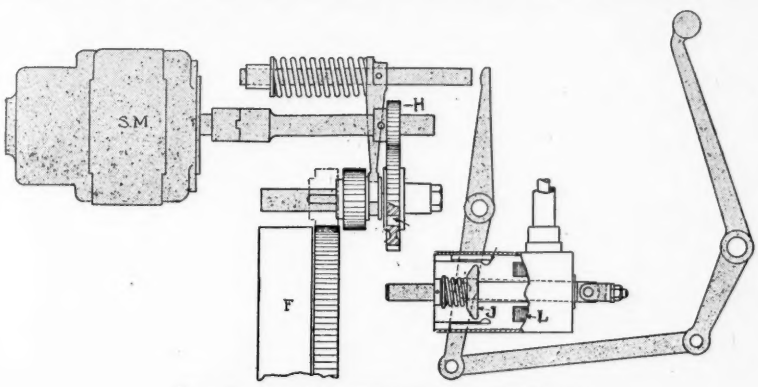


Fig. 4.—The Westinghouse Engine Starter.

starting motor is in operation. A roller free-wheel clutch on the intermediate shaft, allows the engine to over-run the motor, as soon as the former commences to run under its own power, the current to the motor having then to be switched off.

*The Remy.*—Still another example of the separate unit installation was found on the Mitchell cars, built at Racine, Wis., U.S.A., which are fitted with ignition magneto, lighting dynamo and starting motor, all made by the Remy Electric Co., of Anderson, Indiana. The series-wound motor, which takes current at 6 volts, has a pinion which can be brought into and out of engagement with a large pinion, formed not as usual on the fly-wheel periphery, but separately mounted on the shaft between the clutch and the gear box. The controlling pedal has two movements, the first of which brings the gears into mesh and the second switches on the current, a roller clutch enabling the engine to over-run the motor as soon as the former commences to run under its own power.

*The Gray & Davis.*—Another American separate unit starter is the Gray & Davis, made by the company of that name, of Boston, U.S.A., and shown on the Overland cars. It works at a pressure of 6 volts, and is connected to the engine either by a direct chain drive to the crankshaft, or through the medium of a pinion which can be brought into mesh with a toothed ring on the fly-wheel, the first movement of the controlling pedal being to mesh the gears—a small current is allowed to pass to the motor to assist the operation—and next, the switching on of the full current. Two sizes of this machine are made, both being designed for a working speed of 1,500 R P M., the ratio of the pinion and the fly-wheel ring varying from 15 to 1 to 20 to 1. It is stated that on the average from 80 to 120 amperes are used in starting up an engine. The motor is protected against being driven by the engine, when it commences to fire, by an over-running clutch which is applied to the gear train between the motor and the fly-wheel.

*The S.E.V.*—A French electrical starter, known as the S.E.V., was shown fitted on a 40 H.P. Berliet car. So far I have not been able to secure any particulars of the machine, but, as exhibited, the principal feature is the fact that its location on the chassis has been carefully studied—a remark which also applies to the lighting dynamo by the same makers. The motor is constructed in conjunction with the gear box, one of the pinions of which it drives through worm gearing. As distinct from all other systems, there is, in this case practically nothing to see, everything being enclosed. The machines are being manufactured by the Société d'Eclairage des Voitures, of Suresnes, Paris, which has, I understand, been formed by a syndicate of leading French motor-car manufacturers to acquire certain rights held by the Thomson-Houston Co.

*The Magician.*—Two other electric starters, one being a separate unit and the other combined with a lighting dynamo, are being introduced by the United Motor Industries, Ltd. They are of French design and known as the "Magician." As, however, at the time of writing, I have not been able to obtain full particulars of the machines, a description must, for the moment, be deferred.

### Combination Lighting Dynamos and Starting Motors.

*The Delco.*—A leading place in the list of combination machines must be given to the Delco, made by the Dayton Engineering Laboratories Co., of Dayton, O., U.S.A., by reason of the fact that it may be termed the pioneer appliance of the kind, this being the second year that it has been shown as a standard part of the equipment of the Cadillac (American) and Lanchester (British) cars, while it is also now being employed on the Hudson (American) vehicles. Interest in the arrangement is also increased by the fact that it is the only one that serves the triple purpose of car lighting, engine starting and ignition. The machine is of the compound-wound type, with fields in two sections, multiple-wound for charging the battery, and series-wound for use as a starting motor, the same armature being used for both purposes. There are two sets of gearing to the motor, one of which is direct from the timing gears as a generator drive, and the other a reduction gear to the toothed fly-wheel of the engine, for use as a motor in starting. A controller forms an important part of the outfit, this consisting of a number of switches, so arranged that at one position the battery is wired to the series winding of the generator, converting it into a motor, and in the other in multiple to the four sets of cells of which the battery is composed to the multiple winding of the generator, for charging. A differentially-wound automatic cut-out breaks the charging circuit when the speed of the engine, and consequently of the generator, falls too low to overcome the voltage of the battery, thus preventing the latter from discharging itself. The battery consists of 12 cells, arranged in groups of three, of 6 volts each; they are normally wired in multiple to the generator, which charges them at 6 volts, and to the ignition and lighting system, to which the battery discharges at the same pressure. For engine starting, however, the battery current is taken in series at 24 volts. The first function, that of ignition, is accomplished by taking the current from the controller as a primary current, and inducing a high-tension current with it in a single-unit induction coil, which high-tension current is distributed to the sparking-plugs of the engine by a gear-driven distributor, included in the generator group. The second function—lighting—is accomplished by taking current from the controller at 6 volts, and conducting it through a lighting switch to the individual set of lamps, in parallel. The engine starting function is accomplished by switching the current from the battery back through the generator, in a series winding, distinct from the multiple winding employed for charging. For engine

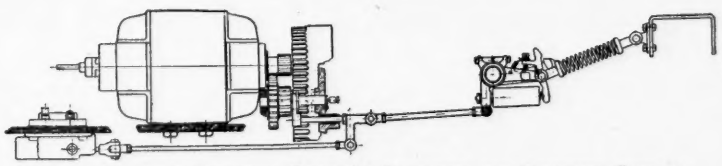

Fig. 5.—The Delco Combined Ignition, Lighting and Starting System.

starting, the clutch-pedal is pushed out, with the ignition retarded. This operation meshes the reduction gears of the generator-motor with the toothed fly-wheel, and moves the controller to the position wherein all the cells of the battery are in series to the series-winding of the dynamo, at the same time operating the starting clutch, which locks the starting mechanism fast to the clutch-pedal. When the engine responds, the ignition is advanced, and the pedal released, whereupon the controller is again shifted to its normal position. The latter operation is, on the latest pattern, effected by one of the motor brushes, which is so arranged that when the clutch pedal is pushed forward in the act of operating the starter the brush is brought in contact with the motor commutator. As soon as the engine starts, and the clutch pedal is allowed to come backward, the brush is lifted from the commutator to a position where another contact is made, thereby bringing the generator into operation. Another modification in the latest arrangement is the adoption of an earthed return for the wiring system, thus reducing the amount of wire by about one-half. There are many interesting features in the Delco system which it is impossible to deal with on this occasion. At first glance, the system may appear complicated, but that this is more imaginary than real is indicated by the fact that the only trouble experienced by the Cadillac Co. was in connection, not with the electrical machine, but with the accumulators, and this trouble having now been overcome, no further difficulty has arisen.

*The T.A.T.*—Another example of the double-purpose machine is seen in the T.A.T., which is the result of two years' experiment by Messrs. Tattersall & Tattersall, consulting engineers, who have made over the sale of the sets to the Imperial Motor Industries, Ltd., London, by whom it was exhibited. The machine is a compound-wound combined dynamo and motor. When working in the former capacity, it has an output of 250 watts at 12 volts, and, by means of a special arrangement of the field windings, the output is claimed to remain absolutely constant, irrespective of engine speed, *i.e.*, when the minimum speed necessary for charging the cells has been attained. The armature case is of the slotted type, while the field coils are former wound. There being no electrical circuit-breaker, a free-wheel clutch is employed; this being incorporated in the driving mechanism, its purpose being to allow the armature of the dynamo to be free-wheeled by the reversal of current from the battery in the event of the circuit not being broken when the engine stops, or when its speed falls below the

rate necessary for balancing the voltage of the battery. Enclosed in the driving end of the casing is an epicyclic gear which is automatically brought into action when the machine is to be used for starting purposes. The closing of the circuit by means of a push-button on the switchboard first excites a solenoid, which locks the drum carrying the planetary pinions of the gear, by means of a pawl and toothed rack cut upon its periphery. The motor then drives the engine through the epicyclic reduction gear, this continuing until the engine starts, when the motor being relieved of load, the current passed is insufficient to hold the pawl in position. The latter is, therefore, automatically released, even should the starting-button be kept depressed, and the motor is then run as a dynamo, and commences to again deliver current to the battery. The two end covers of the

Fig. 6.—T.A.T. Combined Lighting Dynamo and Engine Starter.

machine are detachable, the removal of one exposing the brushes, and of the other the epicyclic gear, which gives a large gear reduction and high torque for starting, and a small reduction for driving as a dynamo. The gear ratio is adjusted according to the size of the engine to which the appliance is to be fitted, the example displayed having a 14 to 1 gear for starting, and 2 to 1 for charging. The only connection with the engine is a silent chain connecting the crankshaft with the spindle of the dynamo-motor. The charging switch has three positions, namely, "Off," "Half Charge," and "Full Charge." The intermediate position cuts out part of the field windings of the dynamo and the generator then delivers only a small "soaking" current to the batteries. "Full charge" only requires to be used when all the lamps are alight. With the charging switch in the "Off" position the armature runs

Fig. 7.—T.A.T. Machine with End Covers Removed.

idly without absorbing any power, as the winding circuits are all open and no current is generated. Furthermore, it is claimed that, should the engine be stopped with the charging switch on, no harm would take place, as it would take about 50 hours to run the batteries down under these conditions, while the slight noise of the machine running would warn the driver before he left the car. It is stated as a testimony to the reliability and efficiency of the apparatus as a starter that it can give not less than 200 starts without reducing the battery current below the critical mean. It is also claimed that this machine is capable of starting the largest engines, both four and six cylinder, from cold against full compression, and with magneto ignition alone. It weighs complete about 120 lb., inclusive of the battery, switch box and lamps, while its lighting capacity is described as being much beyond normal requirements, even for an interiorly-lighted car.

(*To be continued.*)

**Morocco.**—Since May, 1911, a detachment of telegraphists has connected all the military stations with either wireless telegraphy or landlines, the latter exceeding 2,000 km. in the aggregate.

## INSTITUTION OF ELECTRICAL ENGINEERS.

### Scottish Local Section.

At the opening meeting for the session, held in Glasgow on Tuesday, 11th inst., the new Chairman, Mr. J. A. Robertson, chief electrical engineer to Greenock Corporation, gave an address on the subject of "Recent Progress and Limitations in Electrical Development." The author pointed out that they were passing through a period of extremely rapid development in the multifarious applications of electricity, and questions which appeared but a few years ago to be in the domain of pure speculation were now claiming attention as practical problems waiting for solution in the near future. The efficient utilisation of the natural fuel resources of the country by concentrating the generating plant in large central stations and transmitting energy over areas extending to hundreds of square miles, the abolition of the smoke clouds which disfigured and polluted our cities and towns, the electrification of our railway systems the possibility of replacing existing systems of motor traction on our streets by cheaper, cleaner and safer methods, the application of electricity on a large scale to chemical processes, and its employment in the production of steel and iron, these were some of the questions which would claim attention from the electrical engineer within the next few years. The possibility of concentrating power generation in large central stations was primarily due to two causes—first, the improvements made in the steam turbine during recent years; and, second, the development of high-pressure polyphase systems of transmission. In his opinion a modern power station equipped with water-tube boilers and steam turbines represented practically the limit of economy, so far as present knowledge went. A 5,000-KW. turbo-generator would deliver a unit of electricity at its terminals for about 13½ lb. of steam at 550° F., with a 28-in. vacuum at the condenser, while a 10,000-KW. set might bring the figure down to 12½ lb. This appeared to be the limit of economy in the existing state of progress, and it was possible to supply energy from central stations under these conditions at rates cheaper than any private user could generate it for himself. But this only meant an overall thermal efficiency in the station of about 15 per cent., 30 per cent. being lost in the boiler house, 5 per cent. through friction and radiation, and 4 per cent. in generating losses, while the remaining 46 per cent. was rejected in the form of heat to the condenser. To improve the efficiency of the turbine, they required to increase its range of temperature by additional superheating of the steam, and the difficulties in the way of doing this would, in his opinion, be overcome. The advantages of the Diesel engine were next enumerated, but Mr. Robertson voiced the view that engineers would do wisely in confining themselves to a type of plant for central-station work which could be operated with coal—Britain's natural fuel—of which they had, and were likely to have, an abundant supply for many years; 4,000 H.P. appeared to be the present limit for single-stage gas-producer engines, and if they could combine the mechanical and operating advantages of the steam turbine with the thermal efficiency of the gas engine, they should have a much improved combination and might manage to raise their station efficiency from the present figure of 15 per cent. to something like 25 per cent. Turning to transmission, Mr. Robertson pointed out that transmission of energy by high-pressure polyphase current had become standard practice, and in view of the adaptability and efficiency of this system for all conditions it was hardly likely to be superseded. The use of polyphase low-pressure current for power purposes was also on the increase, and in the light of present experience it might be questioned whether central station engineers had acted wisely in adopting wholesale a three-wire transmission system which temporarily increased the economical radius of supply, but had since proved to be only a stop-gap between the low-pressure two-wire direct or single-phase current and the present system of high-pressure transmission. Reliability of supply and absence of breakdown either to the mains or to the wiring on consumers' premises were of primary importance, and from this point of view the simplest and most reliable system was undoubtedly a two-wire system of distribution with high-pressure transmission to sub-stations. The undertaking with which he was connected employed three-wire distribution partly from the generating station and partly from sub-stations, but on an extension to a neighbouring burgh now being carried out they proposed to use a two-wire distribution system throughout for power and lighting. In this case they had to deal with a number of consumers with demands ranging from 200 KW. up to 800 KW., some of them having private installations running at pressures from 200 to 250 volts. The position of these consumers enabled them to be grouped together on two sub-stations with short lengths of feeders, and on going into the matter he decided to adopt the pressure of 250 volts on a two-wire system for both kinds of supply. The additional expense involved as compared with a three-wire system for the same area was not more than 25 per cent. in this particular case, and he was of opinion that the saving effected in balancers and switchgear and the benefit of interchangeability between the power and lighting systems, combined with simplicity and safety, would fully compensate for the extra cost. Recent developments in the manufacture and use of storage batteries were claiming considerable attention, and in one large municipal station a battery capable of discharging 3,000 KW. on a one-hour rating had been installed. This was still a long way behind the sizes of batteries employed in lighting stations in America, where it was not unusual to keep a battery capacity sufficient to take the whole of the station load for short periods. The New York Edison Co. kept a battery of 11,000 KW.-hour capacity on a one-hour rating, which was capable of dis-

charging at 25,000 KW. for short periods. The use of such batteries was two-fold. They could be employed to deal with sudden demands and also the peak loads, and for this purpose might be compared with an equal capacity of generating plant. Their more important function was, however, to take up the load automatically in the event of a breakdown to any unit of the generating plant. From that point of view he thought that a large battery was justified. As to storage batteries, the chief limitation there was the use of lead for electrodes and acid for the electrolyte. Much had been done to improve the lead battery both mechanically and chemically, but many of the original defects still remained. In America much attention had been given to the storage battery for automobile purposes, and many of the defects of the lead battery appeared to have been successfully overcome. The greatest advance was undoubtedly the battery invented and perfected by Mr. Edison, after eight years' experiment. In this battery the lead plates were replaced by electrodes of steel and nickel, and an alkaline electrolyte was employed instead of acid. It combined comparative lightness with great capacity, and mechanical strength was attained without any reduction in efficiency. It could be discharged at almost any rate up to short-circuiting rate without apparent injury, and although it was advisable to charge at normal rates, it was possible to give the cells short "boosting" charges of half an hour's duration at five times the normal charging rate. The use of an alkaline electrolyte overcame many minor troubles such as corrosion of terminals experienced with acid batteries, and the mechanical arrangement of the electrodes and terminals was a great advance on former practice. At present it was somewhat expensive compared with the lead battery, and its use at first would be chiefly for automobile purposes. The makers claimed that when used on a taxi-cab service doing an average duty of 50 miles per day, the battery would propel the car 150,000 miles—practically a 10 years' life—without requiring renewals or mechanical repairs, and they were prepared to enter into a guarantee that after four years' use under all possible conditions of automobile service, the car would retain its original capacity. If these claims were substantiated, it appeared that they were at the beginning of a new development of automobile work which was bound to have a far-reaching effect on the electrical industry. They had had practically no experience of electric automobiles in this country beyond one or two half-hearted attempts which were made some years ago to run electric 'bus and cab services in London. On the other hand, there were in the United States over 20,000 electric automobiles in daily use, and over 40 firms engaged in their manufacture. The capital invested in the industry was £12,000,000, and the energy used for charging was estimated at 65 million units per annum. What opportunity was there for the electric automobile in this country? Compared with the petrol car, the advantages of the electric were simplicity of construction, freedom from repair, easy and noiseless running and better control. With electricity at 1d. per unit it compared very favourably for economy with petrol cars under present conditions. As the batteries could be charged at times convenient for the station, the load was one which most station engineers would be glad to supply at ¾d. or even ½d. per unit. The limitation of the electric car was, of course, its restricted radius of travel on a single charge. Even although charging stations were established over the country, this would still constitute a disadvantage to those who desired quick travelling over long distances. There was still an enormous field, however, for the electric car in cities and towns, where its advantages over the petrol car would be specially appreciated. The commercial electric car offered still greater possibilities for the use of secondary batteries. In this case the disadvantage of limited radius and moderate speed did not apply, and as an instance of what was being done with commercial electric cars, he stated that when he was in Paris on the occasion of the visit of this Institution last May, he took occasion to pay a visit to the municipal department, which was responsible for the collection of the city's refuse and its transmission to the destructors. He had an opportunity of examining and testing some 5-ton electrically-propelled refuse wagons, one or two of which had been in experimental use for nearly two years. One could not help being impressed with the superiority of the electric car for this class of traffic, and an order had been placed by the Paris municipality for 100 electric wagons, the idea being to replace gradually the whole of the horse-drawn vehicles used by the department, while several other Continental towns had decided to adopt the electric car for municipal purposes. There was a big field here awaiting electrical engineers in this country, and it was hoped that when this new branch of business was introduced they would go in for a complete system of standardisation from the beginning. Generally speaking, the outlook for the electrical industry was never more hopeful than it was at present. Electric lighting had passed out of the region of controversy, while the electric motor was rapidly superseding all other forms of power application. Another branch which had developed rapidly of late was electric heating and cooking. The convenience and cleanliness of electric heating constituted its unique advantages, and its limitation at present was purely a financial one. With regard to electric cooking, the position was still more favourable. The only exception at present was the difficulty of furnishing an adequate supply of hot water for all household purposes. In the meantime the best arrangement seemed to be a combination of electric cooking with a water heater fired by anthracite or coke. It was at least a debatable proposition whether their local authorities would not be justified, from the public health point of view alone, in selling electricity for domestic purposes even at a loss, in view of the tremendous benefits to be attained by abolishing the smoke cloud over their cities and towns.

## Dublin Local Section.

At the opening meeting at the Royal College of Science, Dublin, on November 14th, Mr. J. Marshall Harriss, M.I.C.E.I., the new chairman, read an address, of which an abstract is given below:—

We have experienced nearly three months of the effects of labour unrest in our own city, brought about, not in the ordinary way by Trade Unionism as we heretofore understood it, but by Labour Unionism gone mad. Never, perhaps, was a more wanton strike called; never was labour so badly advised and led, and never was a cause more grossly misrepresented.

Labour leaders should remember these common-sense laws of strikes:—

1. No strike can be ultimately successful in which the manner of its initiation or conduct alienates public sympathy. The public is stronger than any local strike, and will be found to be stronger than any general strike.

2. No strike for wages larger than the industry attacked can afford to pay, can be ultimately successful. You may succeed in the immediate object, but you ruin the industry and decrease employment.

3. Industries which can be transferred—will be transferred if labour conditions reduce profit unduly, or hamper the free action of employers, and so decrease local employment.

I believe that not a single person interested in the commercial prosperity of this city has escaped injury. The tramway company was early marked down by the labour agitators for violent attack, but, of all the concerns so marked, it is the one that has suffered the least.

If the industrial prospects are now brighter, unfortunately there will remain great losses to be recovered, and great suffering amongst those who have been out of employment, and still remain so, and quite uselessly; but it is the earnest wish of this Institution that all outstanding differences may be settled in a permanent manner, and the old friendly feelings restored between the workmen and employers.

Apart from these troubles, the prospects for our profession are highly satisfactory. No doubt the Board of Trade regulations prohibiting the use of bare overhead wires carrying high potentials, have been largely responsible for keeping back the progress of electricity supply from large central stations over wide and thinly populated areas. These regulations are being steadily relaxed, and now municipal undertakings stand most in the way of expansion. They themselves are unable to go far afield, and their trading instincts prompt them to prevent anyone else from undertaking this work. But the great central power stations must come sooner or later, and the sooner the better for the country at large, and incidentally for the electrical engineer.

In traction work great progress has been made in the ever-increasing number of passengers carried. According to the last Board of Trade returns, there were 220 million more passengers carried than in the previous year. On the railways there has been a great falling off.

All the large undertakings, especially the older ones, are busily engaged in their workshops, redesigning their rolling stock to better meet the increasing demands; the tendency being for larger cars, covered-in tops and faster running, which calls for more powerful equipments. Where new track is being laid, or old work renewed, the tendency is in the direction of heavier rails and more costly work all round, with the object of making the work as permanent as possible. In the overhead equipment and in the methods of distribution of electrical energy, very few changes have been made or called for in recent years. Phosphor bronze and other alloys are finding favour when replacing the trolley wires, originally of hard-drawn copper. A most important matter to both tramway undertakings and the public is the recent agreement of the Postmaster-General to use covered wires instead of bare wires in all cases where the Post Office wires cross the tramway overhead, so doing away with the necessity for guarding the trolley wire in such places with the cumbersome and dangerous network of steel stranded wires. In the generating station the increasing cost of coal calls for the engineer's more careful attention every day. The reciprocating steam engine is giving way to the steam turbine, but it still is doing excellent service in conjunction with turbines of the exhaust or mixed-pressure type. Engines of the internal-combustion type are no nearer finding a place in the large power stations than they were some years ago. Higher steam pressure and superheating to a degree far in excess of anything we have heretofore been accustomed to, are coming in; the consequences cannot be viewed without apprehension, for the necessity for better material, higher class workmanship, more costly maintenance charges, and more careful attention will increase with the pressure and temperature.

In the boiler house there is more room for improvement than in any other part of the power house. The Bonecourt boiler, which is designed for gas firing, promises almost to revolutionise methods of steam raising; it opens the door to all fuels, such as peat and sewage sludge, and while an efficiency of 92 per cent. is claimed for the boiler, valuable by-products can be recovered from the gas producer.

With cheap fuel, whether at the pit mouth, or in this country at the bog side, and with improvements in boilers or gas engines, and with a satisfactory single-phase A.C. motor, perhaps we may yet see electricity largely used in the cultivation of the land, and so become the means of solving a great economic difficulty in that direction.

In one very important direction we are working very much in the dark; I refer to the money we are spending on the upkeep of

machinery, and the absence of records to enable us to judge better of the value we are getting for the expenditure. We usually class money spent in this way under the heads "Maintenance," "Repairs," and "Renewals." These terms explain themselves, but the difference between them is not generally understood. The object I have in view is to suggest a simple way of keeping records which will enable us to ascertain the value of each particular machine at any time as affected by the work it has done, and the money that has been spent on keeping it in order. If we can get this far, we shall also have a means for finding from our records when any machine has reached the end of its economical life. The system I propose involves the opening of an account for each separate unit or piece of machinery, and in these accounts the money spent on that unit is assessed as follows :—

Under maintenance put the cost of any minor parts that regularly wear out more rapidly than the whole, being common more or less to all machines of the same kind, such as re-lining bearings with white metal, new brushes for a motor or generator, &c.

Under renewals charge any part that is put-in complete and which part puts the unit as a whole (making allowance for wear and tear) into the condition it would be in when the whole was new. It is not necessary that a renewal be always made with an absolutely new part. Credit would be allowed for a part taken out of a machine when that part either has a scrap value or is available for use again after repair. Under repairs must be put everything that is done other than maintenance or renewals. When a part that has been repaired is renewed, the cost of such repair no longer stands against the unit, and it is left out of consideration in arriving at its value.

In the accounts kept in the above form a very accurate analysis of the expenditure would exist. They would contain a record as to the amount of money spent on each unit and the direction in which it went.

A ready means for arriving at the actual value at any time would be provided by deducting the depreciation from the original cost and adding the scrap value, depreciation being arrived at in the following way :—

$$\text{Depreciation} = \frac{\text{Original cost of machine.} \times \text{time working}}{\text{Life time}} + \left\{ \begin{array}{l} \text{Depreciation due to the nature of the repairs standing} \end{array} \right.$$

The original cost and the time working are figures available.

The life time if not settled would be arrived at in whatever way experience showed to be the best.

As to the Institution, I do not know what are the actual results of the recent changes in our constitution. The creation of the "graduate" class no doubt has already brought in, and will continue to bring in, many desirable men who otherwise would not have been reached, but I know that last year a number of men who sought admission and were offered the graduate class, refused it on the ground that the qualification lowered rather than raised their status and they were better without it.

We have followed the lead of the Institute of Civil Engineers in instituting entrance examinations ; this is good, but we should go further, engineering is not legally a learned profession, it is a trade. The solicitor's clerk is not a solicitor ; the apothecary's assistant is not an apothecary ; the apothecary is not a doctor ; the sexton is not in holy orders, and the mechanic who makes up sets of false teeth is not a dentist. They cannot call themselves such, they cannot act as such by law ; but the plumber, the wireman, the engine driver, the commercial agent of a manufacturer, are all "engineers," and can, and do, act as engineers, and can, and do, recover fees as such, independent of qualifications. How can this be mended ? There appears to be no use in relying upon the Institute of Civil Engineers, which appears to be an autocracy run from Westminster. Our Institution with its Local Sections and its more democratic organisation is more fortunately situated, and we had better rely upon ourselves. If there were no precedent it might seem hopeless to evolve order and create a profession out of the present chaos.

Fortunately we have in the Medical Act of 1858—barely 50 years ago—an example of how the thing not only can be, but has been, done. In that year the medical profession was in much the same state as the engineering profession is now—with no standard of qualification and no legal rights. In that Act no injustice was done to anyone then earning his living as a *bonâ fide* medical practitioner, and if we follow suit any Act sought by us must fulfil the same condition.

On August 2nd, in the year 1858, an Act of Parliament was obtained for the medical practitioners, so that "Persons requiring medical aid should be enabled to distinguish qualified from unqualified practioners," the effect of which was to raise the status of the profession of medicine and surgery, making it illegal for anyone to practise unless registered as the possessor of *bonâ fide* qualifications. The Act, after providing for the formation of a Medical Council and branches and the appointment of a Registrar, enacts (Sec. 15) that every person then possessed of certain qualifications described in the Schedule (*a*) shall upon payment of a fee be entitled to registration.

Sec. 18 provides that any person who was actually practising medicine in England before August 1st, 1815, or some 33 years before the passing of the Act, was entitled to registration upon making a declaration to that effect, while the Schedule (*a*) referred to, provided for the taking-in of everybody who had any reasonable qualifications for recognition.

Sec. 31 gives power to every registered person to practice medicine or surgery, or both, as the case may be, according to qualifications, and confers certain rights as to recovery of fees by law, but legalises such by-laws as may be made by any College of Physicians preventing its Fellows or Members from suing for fees.

The next section provides that only registered persons can recover fees by law.

Sec. 36 sets out the appointments that an unregistered person cannot hold. These include every public appointment that is of standing, such as physician or medical officer to the Military or the Navy or any public institution, friendly society, &c., while Sec. 37 enacts that no medical certificate will be valid unless signed by a person registered.

Sec. 40 enacts that any person who shall wilfully and falsely represent himself as registered when he is not, shall, upon conviction, pay a sum not exceeding £20.

Sec. 46 provides for persons practising abroad.

This early Act was amended twice in 1858 and once in 1862, 1868, 1873, twice in 1875, once in 1876, 1883, but this Act was repeated three years later. The last amendment Act is, I think, that of 1905, giving power to extend portions of the Medical Act of 1886 to the Colonies.

None of the subsequent Acts departed from the original purpose of the Medical Act of 1858 ; on the contrary, except that the powers were made to reach further, and ladies were allowed to qualify for registration (the Medical Act, Royal College of Surgeons of England, 1875), the subsequent Acts strengthened and further raised the status of the medical practitioner.

The Perjury Act of 1911 (1 & 2 Geo. V, Cap. VI), Sections 6, 7, and 17, gives power to punish persons, aiders or abetters, &c., for making false declarations, by imprisonment or fine or both, in respect to attempts to procure false registration.

Before the year 1888 the dentists, like the early physicians, seeing that their profession was being encroached upon by unqualified persons, and those qualified were without any protection or distinction, got together, and as a result an "Act to amend the law relating to dental practitioners" was passed in that year. This Act is not so useful to the dentists as the Medical Act of 1858 to the doctors ; it is, I understand, shortly to be amended, but to do this successfully now, and secure a useful instrument, no injury must be done to those already established.

The way to raise the status of the engineer is to make engineering a profession recognised by law. The way to do this has been shown us.

## THE BRITISH STANDARD SPECIFICATION FOR CONSUMERS' ELECTRIC SUPPLY METERS.

In the discussion on Mr. Holden's paper (read before the Institution of Electrical Engineers in Birmingham on November 12th, 1913—for abstract see Electrical Review, page 810), Mr. R. A. Chattock said he thought that it was quite time that the specification should be revised and brought up to date, but he did not agree that frequent revision of the specification should be necessary, once every five years being quite sufficient. The only feasible way of ensuring that the best materials and workmanship were used was to require a long period of guarantee. The specification required one year's guarantee only for accuracy, and three years for defective material and workmanship. Five years should be the period required under all these heads, and if this was insisted upon it would ensure that the makers put the best materials and workmanship into their goods. Defects in meters very often showed up two or three years after they had been put to work. The consumption in the pressure circuit should not exceed 2 watts per 100 volts of pressure for both A.C. and D.C. meters. He agreed that the stipulation as to accuracy was too clumsy for ordinary use. An accuracy of within 2 per cent. up or down from full load to one-twentieth load for meters of 10 amperes capacity and upwards, and from full load to one-tenth load for meters below 10 amperes capacity, should meet the case satisfactorily. Meters should be accurate within 2 per cent. up or down for any power factor between unity and 0·25, and this should be the total allowable inaccuracy from whatever cause.

Mr. Fawssett agreed that the size specified for labels was too small ; 3 in. by $\frac{7}{8}$ was a much better size, the holes being $\frac{1}{4}$ in. diameter and $2\frac{3}{4}$ in. apart. Clauses 12 and 13, if taken together, would, in a large power meter, require eight separate indices besides testing ones. Such a number was unnecessary, and tended to wrong readings. The author's emendations to Clause 16 were excellent. The 15 watts of the specification did not apply to large meters ; more than that was necessary, and, moreover, was absolutely insignificant. The lower limit in Clause 20 might be less, and should be made to read as follows :—"The error of a meter shall not exceed 2 per cent. between full and twentieth loads, except that meters below 5 amperes capacity shall not be required to conform to this below ·25 ampere." Temperature errors were the most serious errors in many types of meter, and the least often tested for. All A.C. meters examined by the speaker were fairly good on this score, but most D.C. meters were truly terrible. A reasonably close guarantee for temperature would debar from compliance nine-tenths of the D.C. meters in use to-day, but yet something ought to be done. He suggested that Clause 28 should read : "A variation of 10° F. above or below the standard temperature shall not cause an error in respect of such variation of more than 1 per cent." To include polyphase meters and provide against some of their special sources of error, some new clauses were necessary. He suggested something on these

lines: "A meter intended to measure true power in a polyphase circuit shall be constructed on the 'two-wattmeter' principle and shall not show a greater divergence than 1 per cent. on reversing the direction of both current and pressure in either or both elements, and no more than 3 per cent. change between ·5 polyphase power factor current leading and current lagging." Pressure transformers for use with such meters must when supplied within 10 per cent. of their rated voltage and at the correct frequency give a ratio when loaded with the meters not more than ½ per cent. from the correct ratio. Under such conditions the phase angle must not exceed one-tenth of a degree. Current transformers for use with such meters must when loaded with the meters, and at the correct frequency, maintain their correct ratio to $\frac{1}{10}$ full load within 1 per cent. and to $\frac{1}{10}$ full load within 2 per cent., and the phase angle should not *exceed* 1° from full load to $\frac{1}{10}$ load, nor *vary* more than 1° between full load and $\frac{1}{10}$ load.

Dr. C. C. Garrard said he had found the specification of the greatest use, and Mr. Holden's suggestion that copies of the specification should be sent out with tenders was excellent, but the price of 5s. per copy was prohibitive. As regarded Clause 2, he would prefer a 2½-ampere size instead of a three-ampere size for both D.C. and A.C., as it was exactly half the size of the next larger, and it was very convenient to have this exact relationship. The 75-ampere size might well be deleted, and he did not consider it necessary to have both a 250-ampere and a 300-ampere size. An iron case had the great advantage that it magnetically shielded the interior, but it would be bad to exclude all other cases, for example, aluminium ones; these had the advantage of lightness, which was of great importance in the export trade. He thought the word "unit" was more easily understood by the general public than the words "kilowatt-hour." He strongly disagreed with the suggestion that manufacturers should be called upon to guarantee meters for five years. A motor or clock meter which would work well for one year would certainly, with proper attention, last 10 years or longer. A five years' guarantee might mean a very large expense to the manufacturer or a very small one, depending upon the care taken with the meter and the reasonableness of the user or supply authority, and in the long run the manufacturer would have to cover himself by considerably increasing the prices. With regard to current transformers, the maximum phase error allowed should not exceed ½°. The most serious blemish of the present specification was Clause 18, which fixed the insulation test. The clause as altered to his suggestion would be: "The insulation resistance between all the electric circuits . . . . and the case should be tested by the application of 2,000 volts (R.M.S) alternating-current pressure, having a sine-wave shape, for a period of 15 minutes without any sign of breakdown." The corresponding test pressure between the main circuit and the pressure circuit to be 500 volts A.C.

Dr. G. Kapp pointed out that there was a difference in the working conditions between a meter tested in the laboratory and the same meter in regular service at a customer's premises. This difference was recognised by the German rules, which allowed a greater error in the latter case. In the standard specification it was not stated whether the permissible error referred to laboratory tests or to the commercial use of meters. The important point was the performance of the meter in actual service; for this reason meters should be tested *in situ*, and in view of the disturbing influences, such as temperature variation, vibration, moisture, &c., to which meters might be subjected when in commercial use, it would be right to have two scales of permissible percentage error.

Mr. Taylor said that in the case of generator meters the points to be guarded against were errors introduced by the loads on the three-phase not being equally in balance, also those due to the varying power factors of the load. In the case of instruments on the feeders, there was the error introduced by the insertion of relays, ammeters, power-factor indicators and occasionally "trip" coils in the secondary circuit of the current transformers. This changed the ratio of the transformer, and thereby introduced errors. He offered clauses covering these points.

Mr. A. E. Jepson said with regard to Clause 2 that if the 2½-ampere size was made standard for single-phase meters, it should be made standard for D.C. meters also. The 75-ampere size should stand, for on a 200-volt D.C. circuit this equalled 15 KW., which was a very handy size, and on a three-phase circuit, with a line voltage of about 400 volts it was approximately equal to 50 K.V.A., which was also a convenient size. The author's statement that cases of soft metal or sheet jointed together were not used on the highest class of meters would be hard to uphold. Aluminium cases had been found to withstand all sorts of climates and conditions of humidity, and, when pressed in one piece, were quite strong enough for the ordinary usage which meters were subjected to. A cast-iron cover was likely to give a false sense of security. Clause 10 might very well be entirely deleted, for customers required various particulars to be contained on their labels. Riveting the labels on the covers was not quite satisfactory, as many Corporations were averse to breaking seals on meters until the guarantee period was past. The ordinary slow-moving roller type of cyclometer dial was in considerable demand, particularly by the smaller Corporations. The expression "unit" was better than "kilowatt-hour." In the case of very large meters, the last dial often read in tens, or even hundreds, of units, and the alteration to the clause might have included sizes above 200 units per hour.

Clause 16 was not very applicable to large meters, particularly of the shunted type, for the loss considerably exceeded 15 watts. Meters of the commutator type required at least 1 volt drop, and if a maximum of 0·75 of a volt were specified, radical alterations would have to be made to the design of meters of this type. In the case of shunted clock-type meters, at least 0·2 of a volt was required. With regard to the consumption of energy allowed, a distinction should be made between A.C. and D.C. meters, and it would probably be better to state the watts lost per 100 volts instead of taking the figure of 7 watts for a maximum of 650 volts.

Mr. S. James said there was a decided advantage in having a small number of standard sizes from every point of view. American standards differed from German, and both differed from the British standard specification. All were to be obtained in this country, and there were at least 20 so-called standards to be obtained below 100 amperes. A 2½-ampere meter was to be preferred to a 3-ampere, at any rate for A.C. meters, because a standard set of gears to fit 2½, 5 and 10-ampere meters all running at standard speed, would also fit 25, 50 and 100-ampere meters with no alteration but a change of dial. A 75-ampere meter was quite unnecessary, and so were the 150-ampere and 250-ampere meters. The three-terminal connection was out of date. The second part of Clause 6 should be altered to read: "Watt-hour meters, or meters having a pressure-circuit, shall have the terminals adapted for both the mains to pass through the meter." This would prevent the meter being tampered with, and render a joint on to the main unnecessary. A uniform method of connection would be an advantage. A label marked with the number of revolutions of the rotor in registering one unit was to be preferred. Clause 23 specified a test difficult to carry out satisfactorily, and the following was more practical: "The meter shall not be injured, and its accuracy shall not be permanently impaired by direct connection across the mains through a fuse of double the rated capacity to the meter." This test approached more nearly to service conditions than the specification test.

Mr. C. M. Shaw said that having had the benefit of investigating many of the finest organisations in America, he was particularly impressed with their superior methods of maintaining meters after purchase, which was more important than quibbling about refinement of design. All seemed to work on common lines without duplication, and this was due in a large measure to their adopting a meter code. The development of the code was placed in the hands of the Electrical Testing Laboratories of New York, and many associations joined hands for the further development of the code. An active and representative Committee of operating engineers, and representatives of makers and testing institutions had the duty of considering developments in all branches of meter practice, and a report was presented by a chairman to the various bodies each year. Any improvements, after general approval, were incorporated in the code, thus bringing it up to date each year.

Mr. J. W. Melsom said that in view of the importance of large meters he hoped that any revision would not limit the size to 500 amperes, but would include all "Consumers' Electric Supply Meters." While cast-iron or pressed-steel cases were apparently quite satisfactory for small meters, he did not think they would do for large ones. With a short-circuit current such a case would be liable to become permanently magnetised and to make large errors in the subsequent meter readings. Mr. Holden's proposal to connect cables for currents up to 500 amperes by means of two screws clamping the cable into a hole was somewhat revolutionary. The suitability of such a type of connection for large cables should be very carefully considered. The I.E.E. Wiring Rules provided that all cables larger than 7/18 must be soldered to proper lugs for connection. Meter makers, almost without exception, provided for 500-ampere meters, either soldering sockets or flat surfaces to which copper strip could be bolted. The question of connections was of the greatest importance, and the meter specification in this respect should be considered in conjunction with the Wiring Rules Committee, and with reference to any existing specification such as for ammeters and voltmeters, so that substantially the same type of connections might be allowed for all classes of apparatus used in a permanent installation.

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**New Electrical Ironworks.**—It is reported that the owner of the Ulefas Ironworks in Norway, Chamberlain S. W. Cappelen, has been granted a concession for the erection of a large electrical ironworks for the smelting of iron ore. The new establishment will be erected on the same property as the present ironworks. In the concession is also included permission for the transmission of the necessary electrical energy, which is to be derived from some waterfalls in the neighbourhood, which are now being harnessed. The Ulefas Ironworks is one of the ancient Norwegian works of the eighteenth century, which were all laid down about 1870, with one exception. The works has now, however, been in operation for some years, and an experimental electrical plant has been installed, which turned out 300 tons of electrical pig-iron in 1912. The results have been so satisfactory, that the owner has now decided on starting electrical smelting of iron ore on a large scale. The process employed is a Norwegian process, which is also used at the Tinfos Electrical Ironworks.

**Radium Therapeutics.**—Excellent progress is being made at the Cancer Hospital, London, in the application of radium to the alleviation, if not the cure, of cancer and allied diseases. In some cases complete cures appear to have been effected, while in others the morbid growths have been so greatly reduced that successful surgical operations have been rendered possible. A special department, in the charge of an expert physicist, has been equipped with the most delicate apparatus for research in connection with radium and the Röntgen rays; in this laboratory it is possible to measure one-millionth of a milligram of radium, and to detect the presence of $1/10^{14}$ milligram in water.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### New American Tariff.

**The Board of Trade have now issued in Blue Book form a complete copy of the new tariff as signed by the President of the United States on October 3rd. The rates on electrical and similar goods under the new tariff are given below ; for further information and for details of the rates under the existing tariff, which, by reason of extensive re-casting, cannot be tabulated satisfactorily, readers should see the Blue Book itself, which may be obtained from Messrs. Wyman & Sons, Fetter Lane, E.C., at a cost of 1s. 1d. The rates previously proposed were considerably modified immediately prior to the passing of the Act.**

| | |
|---|---|
| **Mica, unmanufactured :** | |
| **Valued at not more than 15 cents per lb.** | **... 4 cts per lb.** |
| **Valued at more than 15 cents per lb. ...** | **... 25 % ad. val.** |
| **Mica cut, splittings, built-up mica, and manufactures of mica or of which mica is chief value ... ... ... ... ... ...** | **30 % ,,** |
| **Mica, ground ... ... ... ... ... ...** | **15 % ,,** |
| **Electrodes for electric furnaces, electrolytic and battery purposes, brushes, plates and disks ...** | **25 % ,,** |
| **Carbon manufactures not specially mentioned ...** | **20 % ,,** |
| **Carbons for electric lighting, wholly or partly finished :** | |
| **Made entirely from petroleum coke ...** | **...15 c. per 100 ft** |
| **If composed chiefly of lamp-black or retort carbon ... ... ... ... ... ...** | **40 % ,,** |
| **Carbons for flaming arc lamps not provided for ...** | **30 % ad val** |
| **Carbon pots, porous, for electric batteries ... ...** | **15 % ,,** |
| **Structural iron or steel ... ... ... ...** | **10 % ,,** |
| **Ball bearings, &c. ... ... ... ... ...** | **35 % ,,** |
| **Iron or steel wire ... ... ... ... ...** | **15 % ,,** |
| **Telegraph, telephone and other wires and cables composed of metal and rubber, or of metal, rubber and other materials... ... ... ...** | **15 % ,,** |
| **Galvanised iron wire ... ... ... ... ...** | **15 % ,,** |
| **Castings of iron or steel not made up ... ...** | **10 % ,,** |
| **Wheels for railway purposes... ... ... ...** | **20 % ,,** |
| **Steam engines ... ... ... ... ... ...** | **15 % ,,** |
| **Other machinery and other metal-manufactures not elsewhere specified in the tariff ... ... ...** | **20 % ,,** |
| **Telegraph, &c., posts, trolley poles, &c., if wood ...** | **10 % ,,** |
| **Asbestos manufactures ... ... ... ...** | **10 % ,,** |
| **India-rubber manufactures (except druggists' sundries) ... ... ... ... ... ...** | **10 % ,,** |
| **India-rubber manufactures, vulcanised ... ...** | **25 % ,,** |
| **Earthenware and crockery ware :** | |
| **Plain ... ... ... ... ... ... ...** | **35 % ,,** |
| **Painted, decorated, &c. ... ... ... ...** | **40 % ,,** |
| **China and porcelain ware :** | |
| **Plain ... ... ... ... ... ... ...** | **50 % ,,** |
| **Painted, decorated, &c. ... ... ... ...** | **55 % ,,** |
| **Incandescent electric light bulbs and lamps with or without filaments ... ... ... ...** | **30 % ,,** |
| **Glass manufactures not specially mentioned ...** | **30 % ,,** |
| **Marble manufactured ... ... ... ... ...** | **45 % ,,** |

**The following are free of duty : Unmanufactured asbestos ; crude rubber ; asphalte ; scientific instruments ; plumbago ; railway bars, T rails and punched iron or steel flat rails.**

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

24,955. "Electric target." P. Elphick. November 3rd.

24,963 "Electric-bell signalling for railway purposes." F. Raybould. November 3rd.

24,966. "Electric alarm to audibly indicate the movement of marine engines in a direction contrary to that shown upon the telegraph dial." F. S. Dubash. November 3rd. (Complete.)

25,018. "Electric railway-signalling and means therefor." Siemens Bros. & Co., Ltd., and J. Boot. November 3rd. (Complete.)

25,023. "Portable electric lamps." M. E. Feilmann, A. E. Turnham, C. R. Noble, and S. H. G. Stuart. November 3rd.

25,046. "Electrical regulating devices." A. G. Bloxam. November 3rd. (Firm of Robert Boschm, Germany.) (Complete.)

25,062. "Signalling-apparatus." E. C. R. Marks. November 3rd. (Mead Electric Signal Co., United States.) (Complete.)

25,072. "Arrangement and connections of switch-gear and switches therefor." Siemens Bros. Dynamo Works, Ltd., C. A. B. D. Koettgen, and R. A. R. Bolton. November 3rd.

25,073. "Arrangements for connecting two electrical sources in parallel." Siemens-Schuckertwerke G.m.b.H. November 3rd. (Convention date, June 7th, 1913, Germany.) (Complete.)

25,077. "Type line-casting machines." H. Wade. November 3rd. (Electric Compositor Co., United States.) (Complete.)

25,085. "Telescopic radio-telegraphic masts." T. D. Smith. November 3rd. (Complete.)

25,093. "Electric lamps." H. J. Williams. November 4th.

25,107. "Meter applicable to the measurement of electrical energy and also to the measurement of electrical power." P. C. Fernando. November 4th.

25,129. "Electrically-operated system of and apparatus for automatic track signalling on railways." E. W. Bottle. November 4th.

25,140. "Electric circuit controller." Westinghouse Brake Co., Ltd., and B. H. Peter. November 4th.

25,141. "Electrical connectors for electro-medical apparatus." Siemens Bros. & Co., Ltd. November 4th. (Siemens & Halske Akt. Ges., Germany.) (Complete.)

25,144. "Production of alkali metal alloys by the electrolysis of alkali hydroxide in the molten state and the obtainment therefrom of alkali metals and alkali metal compounds." E. A. Ashcroft. November 4th. (Complete.)

25,163. "Automatic regulating-devices for electric distributing systems." British Thomson-Houston Co., Ltd., and C. M. Jones. November 4th. (Divided Application on 25,286/12. May 3rd.) (Complete.)

25,164. "Systems of and apparatus for control of electric motors on traction systems, trains, and the like." R. F. Baerlocher. November 4th.

25,171. "Electric furnaces." F. T. Snyder. November 4th. (Complete.)

25,179. "Process of welding rails or the like, and apparatus to be used therein." Th. Goldschmidt Akt. Ges. November 4th. (Convention date, December 19th, 1912, Germany.) (Complete.)

25,180. "Welding rails and other fixed constructional parts." Th. Goldschmidt Akt. Ges. November 4th. (Convention date, March 28th, 1913, Germany.) (Complete.)

25,184. "Electric clocks." Nu-lines Manufacturing Co., Ltd., and C. C. Chapman. November 4th.

25,208. "Incandescent electric lamp-holders of the bayonet socket type." S. Morris and W. T. Critcher. November 5th. (Complete.)

25,210. "Miner's electric safety lamps." J. G. Patterson. November 5th.

25,236. "Pneumatic electric current limiting apparatus." T. de Olazabal y Eulate. November 5th. (Convention date, January 25th, 1913, France.) (Complete.)

25,247. "Telephones." C. F. Killar. November 5th.

25,257. "Means for suspending secondary battery plates." H. Leitner. November 5th.

25,274. "Electrical protective systems." E. G. Waters. November 5th. (Addition to 26,961/12.)

25,283. "Telephone systems." J. Savin. November 5th.

25,292. "Transmission of power to the driving axles of motor-vehicles and the like." J. G. P. Thomas. November 5th.

25,316. "Securing-devices for incandescent electric lamps." B. Griffiths. November 6th.

25,327. "Mutiplex telegraphy." E. D. Cather. November 6th.

25,335. "Earthing and bonding clip." J. H. Powell. November 6th.

25,362. "Tubing for conduction and insulation purposes and method and machine for making the same." P. Menzel. November 6th. (Complete.)

25,363. "Electrical conduit systems." M. Railing and T. Taylor. November 6th.

25,385. "Electric storage batteries." G. Inrig and G. J. Mills. November 6th.

25,415. "Electrolytic cells." H. C. Jenkins, H. F. Pattinson and R. Wellesley. November 6th.

25,434. "Wave-detectors for radio-telegraphy and telephony." F. P. W. Allen. November 7th.

25,437. "Device for recording or counting telephone calls." A. R. Denbigh. November 7th.

25,464. "Collector brush-holders for electrical apparatus." W. Christie. November 7th. (Galvanische Metall-Papier Fabrik Akt. Ges., Germany.) (Complete.)

25,465. "Collector brushes for electrical apparatus." W. Christie. November 7th. (Galvanische Metall-Papier Fabrik Akt. Ges., Germany.) (Complete.)

25,473. "Generation and control of electricity, for lighting trains and other vehicles." Gavan Inrig, Ltd., and G. Inrig. November 7th.

25,477. "Electrical switches or circuit-breakers." F. B. Holt and H. Smith. November 7th.

25,479. "Cooling arrangements for electric locomotives." Siemens-Schuckertwerke G.m.b.H. November 7th. (Convention date, May 26th, 1913, Germany.) (Complete.)

25,484. "X-ray apparatus." R. S. Wright and E. E. Burnside. November 7th.

25,503. "Apparatus for effecting the sterilization of water or other liquid by ozonation." E. L. Joseph. November 7th.

25,506. "Mariner's compass." E. Farkas, V. R. von Klarwill, G. R. von Klarwill, and S. Scheer. November 7th. (Convention date, November 7th, 1912, Austria.) (Complete.)

25,531. "Sparking-plugs construction for internal-combustion engines." E. A. H. de Poorter. November 7th. (Complete.)

25,544. "Fittings for electrical conduit systems." D. L. J. Broadbent. November 8th.

25,569. "Safety electric ceiling rose." H. G. Foster. November 8th.

25,586. "Electrical candle-lamps." A. E. Watson and Veritys, Ltd., November 8th. (Complete.)

25,591. "Duplex and like telegraphy." Eastern Telegraph Co., Ltd., and F. Ryan. November 8th. (Complete.)

25,598. "Leakage protective devices for alternating-current distribution systems." British Thomson-Houston Co., Ltd., and E. B. Wedmore. November 8th.

25,599. "Manufacture of electric contacts." British Thomson-Houston Co., Ltd., November 8th. (General Electric Co., United States.) (Complete.)

25,601. "Electrical wiring circuits for motor cars." H. Salsbury. November 8th.

25,607. "Plates or electrodes for secondary batteries." E. H. Naylor. November 8th.

25,612. "Wireless telegraphy." I. S. Winby and R. Garrett. November 8th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1912.

Process for Preparing Metals and Metal Oxides in a Minutely Divided State. Dr. H. Kast. 19,006. August 19th.

Direct Current Dynamos and Motors. E. R. Freeman. 21,415. September 20th.

Glow Lamps Radiator for Cooking or other Heating Purposes. G. E. Dutertre and C. Jacquel. 23,748. October 17th.

Pocket Electrical Lamp Signalling Apparatus. H. Neuburger. 23,887. October 19th.

Means for Indicating when the Flow of Current in an Electric Circuit is Interrupted or Varied. A. F. Berry. 23,940. October 19th. (Cognate Application 27,534/12.)

Machines Suitable for Coating Wires, Threads, Strips, or the Like with Lubricating or other Substance in Liquid Form. British Thomson-Houston Co. (General Electric Co.) 24,058. October 21st.